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TWENTY-SECOND ANNUAL REPORT

OF

THE LOCAL GOVERNMENT BOARD,

1892–93.

SUPPLEMENT

CONTAINING THE

REPORT OF THE MEDICAL OFFICER

For 1892-93.

Presented to both Houses of Parliament by Command of Her Majesty.

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PUBLIC HEALTH.

ANNUAL REPORT

OF THE

MEDICAL OFFICER

OF

THE LOCAL GOVERNMENT BOARD

FOR THE YEAR

1892-93.

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REPORT.

TO THE RIGHT HONOURABLE THE PRESIDENT OF THE LOCAL GOVERNMENT BOARD.

SIR,

I HAVE the honour to submit to you, for presentation to Parliament, my report on the proceedings of the Medical Department of the Board over which you preside, for the year ending Lady Day 1893.

Following on the resignation of my predecessor, Sir George Buchanan, Mr. W. H. Power was appointed Assistant Medical Officer, and he was succeeded in the post of Second Assistant Medical Officer by Dr. H. Franklin Parsons. These changes gave rise to a vacancy in the Medical Inspectorate, which was filled by the appointment, in August 1892, of Dr. H. Timbrell Bulstrode.

The year on which I have to report was an eventful one in the annals of public health in this country; and, under circumstances to which I shall refer later on, it was deemed necessary to add materially to the working strength of the Department by appointing two additional permanent Medical Inspectors, namely, Mr. Arnold Royle, C.B., and Dr. Richard James Reece; and four temporary Medical Inspectors, namely, Mr. Evan Evans, Dr. Thomas Horne, Dr. Samuel W. Wheaton, and Dr. H. Maclean Wilson. These several Inspectors joined the Department early in 1893.

In accordance with custom, I now proceed to give some account of the work carried out by the Department, in the direction of promoting public health, both as regards its administrative duties and the scientific investigations with which it is entrusted.

I.—ADMINISTRATIVE RELATIONS OF THE MEDICAL DEPARTMENT.

1. VACCINATION AND PUBLIC VACCINATION.

VACCINATIO

From the returns made by Vaccination Officers (Appendix A., No. 1.) it appears that of children whose births were registered in England and Wales during the year 1890, there remained 11·3 per cent not finally accounted for as regards vaccination, the per-centage for the Metropolis being 13·9, and for the provinces 10·9. These figures indicate a larger amount of default in regard of vaccination than any which has been

MEDICAL OFFICER'S REPORT.

recorded since the passing of the Vaccination Act, 1871. In the Metropolis the per-centage of births unaccounted for has during the ten years 1881–90 risen almost continuously from 5·7 to 13·9; and in the provinces there has, during the same period, been an altogether unbroken rise from 4·3 to 10·9. A marked increase in these rates took place as regards children whose births were registered during the year 1888, and whose vaccination became due, at the latest, during 1889. In the Metropolis the amount of default indicated is now nearly two and a half times as great, and in the provinces it is nearly two and a quarter times as great as it was ten years ago. The figures are very significant; affording as they do an indication of a steadily growing increase in the younger population of persons who are altogether without protection against small-pox.

ROYAL COMMISSION.

The Royal Commission on Vaccination appointed in May 1889 continued to take evidence on the general subject of their inquiry throughout the year 1892-93, but at the close of 1893 they concluded that portion of their labours.

INSPECTION OF PUBLIC VACCINATION.

During the year 1892, 243 Unions were inspected with reference to action taken under the Vaccination Acts. This work involved personal inquiry by Medical Inspectors in 1,247 Vaccination Districts, and of the Public Vaccinators whose work then came under investigation 855 were recommended for award. The detailed statistics as to this work are contained in Appendix A., No. 2.

NATIONAL VACCINE ESTABLISHMENT.

The sources whence the vaccine lymph, issued by the National Vaccine Establishment, is derived, are shown in Appendix A., No. 3; from which it will also be seen that in answer to 4,514 applications for humanised lymph, 6,562 capillary tubes and 338 charged ivory points were sent out; and that 12,056 points and 65 capillary tubes of calf-lymph were issued in response to 2,992 requests for this class of lymph.

Dr. Cory in reporting on the operations of the Animal Vaccine Station (Appendix A., No. 4) states that 7,616 primary vaccinations and 688 re-vaccinations were performed during the year 1892–93. Of the 7,616 cases of primary vaccination, 7,520 returned for inspection; and in 7,482 of this latter number, vaccination was found to have been successful at the first attempt. In the remaining 38, success was attained at a second operation. In the case of the primary vaccinations, all of which were effected by means of five separate insertions, the insertion-success, in the hands of the several operators varied from 90·8 to 96·7; the per-centage of insertion-success, taken as a whole, being 96·1.

2. OTHER ADMINISTRATIVE BUSINESS OF THE MEDICAL DEPARTMENT.

CONFERENCES AND LOCAL INQUIRIES.

As during previous years, a considerable number of conferences have been held at the office between the Board's Officers and

representatives of local bodies with respect to a number of subjects, especially as to proposals relating to the provision of hospitals for infectious diseases, and the preparation of codes of local byelaws. These conferences, which are increasing in number, are evidently valued by the local authorities concerned; and the representatives of these bodies do not fail, in most instances, to express their appreciation of the assistance thus afforded to them by the Board. In 18 instances Medical Inspectors took part in local inquiries or conferences relating to similar matters.

Other local inquiries undertaken by Medical Inspectors had concern with 17 sanitary districts. These have usually involved detailed investigation either into some local prevalence of disease or into the sanitary circumstances and administration of the districts in question. A summary of this work will be found in Appendix A., No. 5.

ENTERIC FEVER AND PUBLIC WATER SUPPLIES.

But some of these inquiries call for further comment, and this especially in view of the widespread prevalence of Asiatic Cholera on the continent of Europe, and still more by reason of the fact that this disease reached our shores during the autumn of 1892. I refer more particularly to those investigations into epidemic prevalences of enteric fever in which it was shown that the outbreaks of that disease were associated with the use of public water-supplies that were liable to contamination by specific filth.

(a) in the Tees Valley;

In the report which I had the honour of presenting last year on behalf of my predecessor in office, I referred to the impending issue, in folio form, of a report by Dr. Barry on two outbursts of enteric fever, one in the autumn of 1890 and the other in the early part of 1891, affecting certain populations living in the valley of the Tees. That report,* has since been issued. It relates in detail the circumstances of the two epidemics; it shows that the special incidence of the disease in both outbursts admitted of one explanation only; and that this explanation lay in the use of the water pumped by two public bodies from the River Tees, a river which was found to be liable both habitually, and much more so at flood-times, to fouling by human excreta and by other filth. In submitting that report to you I pointed out that, "Seldom, if ever, has a case of the fouling of water intended for "human consumption, so gross and so persistently maintained, "come within the cognizance of the Medical Department, and "seldom if ever has the proof of the relation of the use of water "so befouled to wholesale occurrence of enteric fever been more "obvious and patent." The full text of my Introduction to Dr. Barry's report is reproduced in Appendix A., No. 6.

(b) at Rotherham and neighbourhood;

In my previous report I also referred briefly to the occurrence of simultaneous outbreaks of enteric fever and of "fever" of less definite sort in Rotherham and two adjacent districts, as to

* Supplement in continuation of the Report of the Medical Officer of the Local Government Board for 1891. Enteric Fever in the Tees Valley. (C.-7054) 1893.

MEDICAL OFFICER'S REPORT.

which Dr. Theodore Thomson had recently made inquiry. His completed report is now submitted in Appendix A., No. 7. From that report it will be seen that the outbreak of enteric fever which had occurred in the autumn of 1891 attacked at one and the same time the towns of Rotherham and Rawmarsh, and a limited portion of Greasbrough, three sanitary districts grouped together in the southern part of Yorkshire; and that after failing to find any satisfactory explanation of the fever in some other way or ways, Dr. Thomson came to the conclusion that the water supply belonging to the Rotherham Corporation, and which was distributed through Rotherham and Rawmarsh, as also to a limited part of Greasbrough, was the cause of the outbreak. And it became possible to differentiate in important measure between the two main sections of this water-supply—the high-level service and the low-level service—suspicion attaching especially to the high-level service. The rate of attack was more than four times as great on persons living, whether in one or other town, in the high-level area as compared with the low-level area, and the only enteric fever known to have occurred in Greasbrough in 1891 appeared in that part supplied with high-level water. And when a somewhat persistently maintained excess of enteric fever in Rotherham and Rawmarsh during the nine antecedent years of the decennium 1882–91 came to be examined, Dr. Thomson found that there was strong presumption that the Rotherham high-level service had for a long time been an important factor in the production of an excess of fever, which had at times reached epidemic proportions in these places. This high-level water is derived from a gathering ground comprising 2,200 acres, and from two springs. The greater part of the gathering ground is cultivated, and much of it was found to be covered, down to the very margin of the streams threading their way to the reservoir, with manure in which human excreta were detected. The sewage of villages lying within the area of the gathering ground was another source of pollution. One of the springs, the Wellgate Spring, which provided about one-quarter of the total supply available, and which is still resorted to at times, has again and again come under condemnation by the chemist, and on one comparatively recent occasion the results of analysis of this water were stated to point to "pollution by urine, cesspool drainage, or similar "impurity." The low-level service, which is derived from a separate gathering ground, was not so clearly identified with the dissemination of enteric fever; but it is also open to grave risk of pollution. Speaking of the two gathering grounds together, Dr. Thomson says:—"Both * * * contain a great deal "of cultivated land which is manured not only with farm yard "but also with privy midden refuse." The statement, applying as it does to a town which habitually has enteric fever, suffices to indicate a very obvious source tending to specific pollution of

(c) at King's Lynn.

the water-supply. Towards the close of 1893 this water service remained practically unaltered.*

Another outbreak of enteric fever having special significance is one that took place in King's Lynn, and in a suburb of that town called Gaywood. The occurrence has been reported on by Dr. Bruce Low (Appendix A., No. 8). The disease, which was by no means a new one for King's Lynn, was definitely recognised early in March 1892; during the whole of that month it assumed the proportions of an outbreak, and it only subsided towards the middle of June. This outbreak is the more interesting because it was preceded by a widespread and severe prevalence of diarrhœa, which commenced during the last days of February, and became gradually merged into the definite enteric fever outbreak of March. Some of the later cases of "diarrhœa" were, indeed, found to be indistinguishable from enteric fever, and for the purposes of Dr. Low's report the two diseases were grouped together; the result being that, including several months towards the close of 1891 during which occasional attacks had occurred, there were between September 1891 and June 1892, and excluding numerous slight diarrhœal attacks, 226 cases of severe diarrhœa or of fever in 123 houses in King's Lynn and in Gaywood; 16 of the attacks terminating fatally. Of the 226 attacks which could be learned of at the date of the enquiry, 135 were recognised as enteric fever, but this number cannot be regarded as representing the full extent of the fever epidemic. Both diseases were looked upon by Dr. Low as owing their dissemination to the same local circumstances, and these were found, after careful investigation, to be definitely related to the public water service.

This water is derived from the River Gaywood, which is formed by certain chalk springs arising in and around the village of Grimstone, some six miles above the intake which lies within the borough boundary. The water is pumped to a tower and it is thence delivered by gravitation to King's Lynn and to a considerable part of the village of Gaywood. Two of the springs in question rise directly from beneath Grimstone Churchyard; the river, in its course to King's Lynn, receives slop-water, the soakage from privy pits and refuse heaps, the overflow from cesspools, the contents of drains leading from water-closets and from other sources of filth; and nearer the town, gardens manured with the contents of

* In October 1893 the town council of Rotherham submitted to Dr. Klein, F.R.S., for bacteriological examination, a sample of water from the Wellgate spring, which had come under such strong condemnation in Dr. Theodore Thomson's report issued in August 1892. Having given the results of his investigations, Dr. Klein further reported "that the water is most probably strongly polluted with excremental "matter." No official information has reached the Board as to the attitude of the Health Authority on receipt of this further proof of the pollution to which their water-supply is subjected. But, according to the local press, they do appear at last to have apprehended the dangerous character of the water, for some public notice is stated to have been issued cautioning the inhabitants to boil and filter all water intended to be used for drinking purposes.

The question as to the best means of ridding both of the gathering grounds from the risk of pollution by sewage is also now under consideration.

privy-pits and material from the town "tip" abut upon the stream. "From what has been stated," says Dr. Low, "it is "evident that the water in the Gaywood river has multifarious "opportunities of becoming polluted by human excrement." And, as might have been anticipated, the town supply at times gave obvious indications of the filth it contained. The use of such a water might well, at any moment, give rise to illness. But facts were elicited which went to show how, antecedent to the outbreak under consideration, the storage of the discharges of enteric-fever patients on land sloping to the river bank, and the occurrence first of frost and then of heavy rainfall and melting snow, afforded conditions favourable to the introduction of specific filth into the river and so into the Lynn water-supply. One notable opportunity of this sort extended over several days from February 14th onwards, and it was followed in the month of March by the invasion of 39 houses in Lynn and Gaywood, by enteric fever. For some nine years at least it had been matter of public knowledge that this water was contaminated with sewage.* But as at Rotherham so also in King's Lynn the population were still receiving a befouled water-supply late into the year 1893.†

Such pollutions of public water services as have here been referred to may perhaps be regarded by some as quite exceptional. In certain respects this may be so; but the experience of the Medical Department is to the effect that risk to public water-supplies of specific pollution is by no means uncommon, and that danger of this sort is far less appreciated by the public and by the local purveyors of water than is creditable to those concerned. It might be deemed incredible that so late as the year to which this report relates a Sanitary Authority deriving their water from the surface drainage of cultivated lands should have been found capable of handing over in wholesale quantity the contents of their privies and their ash-pits to one of the cultivators of these very lands, for which the filth and refuse served the purposes of manure. And yet this was the practice of the Local Board of Health of Ashton-in-Makerfield. On the occasion of a visit to Ashton during the European cholera prevalence of 1884–86, one of the Board's Medical Inspectors pointed out to this Authority the danger which they were incurring by the use of "night-soil on the gathering grounds" of their water-supply; and question then arose locally as to their power to prevent the practice. But in 1892, when the causes of a prevalence of enteric fever in the district were under discussion, it was ascertained not only that the practice still obtained, but that the

* Presidential Address for 1883 to the Norwich Geological Society, by W. Whitaker, Esq., F.R.S., of Her Majesty's Geological Survey.

† The town council of King's Lynn, after meeting with a good deal of opposition from a considerable section of the ratepayers, decided by resolution of the 9th of November 1893, to apply to the Local Government Board for a Provisional Order, to be confirmed by Parliament, "To repeal or alter and amend the existing Water-"*works Acts, and enable* the Corporation to improve the water supply of the town."

Health Authority were then actually making a present of this filth to the cultivator of the land. MEDICAL OFFICER'S REPORT.

It is no part of my duty to appraise the responsibility attaching respectively to electors or elected for action such as has been referred to in the several sanitary districts concerned. But it is certain that in the instances related no plea, not even that of ignorance, can be raised either in extenuation of a recklessness that courts disaster, or in mitigation of censure for the consequences which sooner or later must ensue.

A third report which is reproduced in this volume (Appendix A., No. 9) embodies the results of an inquiry by Dr. Copeman as to an outbreak of typhus fever at Wigan, and to a lesser extent in neighbouring parts of Ince-in-Makerfield. Co-incidentally with the improvements which have now for many years been in progress as regards the circumstances of the housing of the poor and working classes in our towns and cities, typhus has largely disappeared from our records of disease and death. Where it still retains any hold upon communities, it is, as it ever has been, identified with that form of filth which goes hand in hand with the unwholesome crowding together of dirty, and often destitute people in dirty and unwholesome houses in overcrowded areas. And Wigan forms no exception to the rule. Typhus, once imported, found its needed means for spread in ill-ventilated and overcrowded "slums"; in houses "conspicuous "for filth and squalor" with attendant vice; and in spots where people lived over heaps of decomposing refuse cast into abandoned rooms below the street level. And, just as in former days "back-to-back" houses stood out as conspicuous amongst typhus haunts, so in Wigan the district mainly affected is one in which this vicious system of building has largely prevailed. Under these circumstances a single case was speedily followed by 11 others in the same house, and by 80 attacks in all between August 1891 and March 1892. The number is small in view of the local conditions which prevailed, and which lead Dr. Copeman to express surprise that the people in the particular portion of the town invaded should ever be long free from illness of the zymotic type. But, happily, Wigan had provided for itself a well-appointed isolation-hospital, which when brought into use served at once to check that rapid extension of the disease with which the onset of the outbreak was marked. TYPHUS AT WIGAN.

But with the disappearance of typhus from our midst, there have also largely disappeared the means necessary to its early identification. And at Wigan, as in other places, the commencements of typhus passed unrecognised. Hence Dr. Copeman has entered, in somewhat unusual detail, into the clinical aspects of the outbreak. This portion of his report can only be appreciated by careful study of the materials he has compiled; but this is probably the portion which gives greatest interest to the record of his inquiry.

In one instance *inquiry was undertaken by the Board on the receipt of a representation by the* Staffordshire County Council COMPLAINT COUNTY COUNC

MEDICAL OFFICER'S REPORT.

to the effect that the provisions of the Public Health Acts were not being properly put into force. The district was the Urban Sanitary District of Brownhills, with the Authority for which the Board were already in correspondence, owing to the unsatisfactory conditions as to water-supply, sewerage, and removal of refuse, which had been disclosed in the annual reports received from the local sanitary officers. Mr. T. W. Thompson's Report (Appendix A., No. 10) shows that in these several matters there had been grave neglect, that there was habitual laxity in the sanitary administration of the district, extending even to the failure on the part of the Authority to enforce the provisions of their own local byelaws; and that generally the Authority had been "but little mindful of their responsibilities in the matter "of safeguarding the health of the inhabitants of their district." Since the issue of this Report the Board have learnt, as the result of a further visit to the district, that some preliminary action has been taken with reference to the extension of the water-mains; that comprehensive measures of sewerage are in prospect; that some improvement in the matter of scavenging has been inaugurated; that the Infectious Disease (Notification) Act, 1889, has been adopted; that a site for the purposes of a hospital for infectious diseases has been acquired; and that, generally, a distinct advance has been made in the sanitary administration of the district.

RETURNS OF NOTIFIED INFECTIOUS DISEASES.

In January 1888, Dr. John Tatham, then Medical Officer of Health for the Borough of Salford, commenced a compilation of the weekly returns of cases of infectious diseases which were notified to himself and to his colleagues in some 30 large urban districts, and a copy of the resulting tabulation was sent to the health officer of each contributing sanitary district, as also to the Board's Medical Officer. The number of towns included in this summary of returns steadily increased, and its compilation soon came to involve considerable labour on the part of Dr. Tatham. Hence, early in 1889, the Board undertook, at his suggestion, supported as this was by the formal request of a large number of the health officers and sanitary authorities concerned, to perform the necessary weekly tabulation, and to issue a copy of the results to the medical officer of health of each of the districts in respect of which the return was supplied.

Weekly returns are now received by the Board from 122 urban districts, including the metropolis, giving certain of the details embodied in the certificates of notification of the different infectious diseases which have been received by the several authorities. The Board's weekly summaries of these returns are not intended for publication, but some general account of them has for several years past been issued in the Board's Annual Report. In the case of 81 of these districts, quarterly returns of mortality are issued by the Registrar General, and although these quarterly returns are open to subsequent correction, yet I have thought it might be helpful

to those concerned in the study and control of infectious diseases, if I tabulated for the towns in question both the notified attacks and the registered deaths from the several notifiable diseases for each quarter of the year. This material for the year 1892 will be found tabulated in Appendix A., No. 11. After a series of years such tabulations may come to afford some useful indications as to the proportion of fatal to non-fatal attacks, and as to the relation of season both to the occurrence of some of the diseases specified, and also to their fatality.

II.—CHOLERA IN EUROPE.

The invasion of Europe by cholera in 1892 was an event which largely occupied the attention of the Medical Department during the year, and the story of the origin and progress of the diffusion of the disease is set out in a report by Dr. Barry (Appendix A., No. 12). From this account, which deals with the countries affected in the order of the date of their attack, it will be seen that cholera, in its extension westward, had three centres. The first was Paris, in the outskirts of which cholera was recognised early in April 1892. The disease in the neighbourhood of the French capital may probably be regarded as a recrudescence of former cholera, and its extension took place down the valley of the Seine, and in the direction of Belgium. The second centre was Asiatic Russia, which must be regarded as having received its infection as the result of an exceptional epidemic of cholera in British India during 1891; this being followed in the early months of 1892 by a recrudescence along the Indo-Afghan frontier. The disease first travelled in a westerly direction through Afghanistan, and then taking a north-western course through Persia, reached Russian Turkestan, through which it travelled with a hitherto unknown rapidity, following the new line of railway from Samarkand to Oozoun Ada on the eastern shore of the Caspian. Thence it followed the line of the Caspian Sea traffic, reaching Baku on the west and the mouth of the Volga on the north. By means of a rapid extension of the disease up the Volga on the one hand, and into the Caucasus on the other hand, the disease was introduced into Europe, and before the end of the year it had already extended to all but six of the Governments comprised in European Russia. The third extension westwards was, so far as is known, not concerned with the European invasion of 1892. Cholera prevailed in Arabia in 1890–91, when a diffusion took place along several pilgrim routes. Early in the summer of 1892 the disease was conveyed across to the Somali coast of Africa; and later in the year it was re-imported thence into Arabia.

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CHOLERA: (a.) IN RUSSIA.

Dr. Barry gives a detailed account of the extension of cholera through the various provinces both of European and Asiatic Russia. By the close of 1892, 331,077 attacks and 151,626 deaths had been recorded in European Russia, and 134,758 attacks with 69,423 deaths in the Caucasus; the areas suffering most being the northern Governments of the Caucasus, the Don Cossack region, and the districts riparian to the Volga. The Government of Lublin (Poland) also suffered heavily. In point of date the heaviest incidence of the epidemic was during the period between mid-July and the end of the first week of September; but the disease was still prevalent in parts of Russia at the close of the year. The records from Russia in Asia showed 89,199 attacks and 46,841 deaths. But, as regards many parts of the Russian Empire, it has to be noted that the actual statistics available fail to indicate the true extent of the epidemic; accurate records being at times quite unprocurable owing to riots and other causes. The story of Russian cholera includes some remarkable records of the manner in which water-ways serving as lines of human traffic served also as carriers of cholera; it also gives details, some tragic in their outcome, which emphasise anew the power for mischief of a cholera infected water when used for human consumption.

b.) IN TURKEY IN ASIA.

In much the same way Dr. Barry traces the importation into, and movements of cholera within, the northern provinces of Turkey in Asia, where the places most effected were Erzeroum and Trebizond.

c.) IN FRANCE.

The first recognised attacks of cholera in France took place in a public institution at Nanterre in the north-western outskirts of Paris, either at the end of March or early in April 1892; they were rapidly fatal, and the disease extended to a considerable number of the inmates. Its origin remains obscure; but it is held by leading French authorities that it was probably a recrudescence of the cholera of a former year, and that it must have reached the institution in question from the outside. During the months of April, May, and June the disease spread through the north-western, western, and northern suburbs of Paris, and later on it nearly encircled the capital. The distribution of cholera in the suburbs is worthy of note; the excess of its incidence on the different communes having distinct relation to the extent to which the Seine, from which their water-supply was drawn, was polluted by the sewage of Paris. Of the 48 communes provided with Seine water 28 were invaded with cholera, but the inhabitants of those communes drawing their supply at a point below the main outfall sewer died of that disease at a rate nearly 14 times as great as those who were supplied from the same river at a point above Paris. Paris itself became affected in July, the disease assuming epidemic proportions between mid-August and mid-October, and maintaining itself more or less until the end of the year.

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According to reports issued by Mons. Henri Monod, 951 deaths from cholera occurred in the environs of Paris between March 31st and the end of 1892, and 907 in Paris itself. It is, however, noteworthy that the 1892 cholera prevalence in Paris was the least fatal of all the seven epidemics which have occurred there during the 61 years 1832–92; the cholera death-rate per 10,000 having continuously fallen from 234·5 in 1832, to 3·6 in 1892.

From the department of the Seine cholera spread first to neighbouring departments, but later on extension took place somewhat generally in the north of France, the disease also appearing in departments situated as remote from the capital as the Bay of Biscay and the littoral of the Mediterranean. In all, 49 departments were invaded, 498 deaths occurring at Havre in the Seine Inférieure, 122 in the commune of Argenteuil in the Seine-et-Oise, 101 in the commune of Lorient, department of Morbihan, 89 at Marseilles in the Bouches-du-Rhône, 87 at Cherbourg in the Manche department, 61 at Nantes in the department of the Loire Inférieure, besides 59 and 33 at Le Portel and Boulogne-sur-Mer, as also 43 at Etaples and 25 at Calais, all in the department of the Pas-de-Calais. The total cholera deaths recorded in France during 1892 was 4,550, giving a rate of 1·75 per 10,000 of the population of the invaded departments.

(*d.*) IN BELGIUM.

According to reports received from Belgium, the first occurrences of cholera in that country would appear to have been related to the cholera which had prevailed since mid-April in the departments of the Seine and Seine-et-Oise immediately outside Paris. Thus, isolated attacks of cholera which occurred in two provinces of Belgium during the month of July, followed on the return to their homes of men who had been at work in localities within the departments of France referred to. And the introduction of cholera into Antwerp is also stated to have followed on the occurrence of that disease on board ships immediately after their arrival from Havre, where the disease was then widely prevalent. From Antwerp cholera gradually spread, until by the middle of September nine provinces, and a considerable number of towns and villages, had become infected. By the end of the year 1,852 attacks and 961 deaths had been recorded, the rates per 10,000 of the population being 3·0 and 1·6 respectively, with a fatality rate reaching 51·8 per cent. of attacks.

(*e.*) IN GERMANY.

In Germany both the Imperial and the Prussian Governments took precautions early in July for the prevention of cholera, these steps being especially directed to the control of the large emigrant traffic passing between infected Russian provinces and ports on the north-east of Germany, notably the port of Hamburg. The raft and river traffic also came under special regulations. Notwithstanding these and other measures, cholera broke out in Hamburg about August 16th, and it soon became widely epidemic in the city and port, 16,956 attacks and 8,605 deaths occurring between August 16th and the middle of November.

This epidemic, which gave rise to an annual death-rate from cholera of 134 per 10,000 of the estimated population, was the most severe from which Hamburg has suffered on any of the sixteen occasions in which cholera has prevailed in that city. The circumstances under which cholera was introduced into Hamburg are discussed by Dr. Barry; but although they remain somewhat uncertain, no doubt can exist with regard to the fact that the infection was widely distributed by means of the sewage-polluted water which was at that time delivered to the population from the River Elbe. Indeed, the experience afforded by Hamburg in respect of water serving as the medium for the diffusion of cholera in epidemic form has become historic by reason of the researches of Professor Koch and others, which went to show that whereas Hamburg, drinking unfiltered Elbe water drawn from a point above the sewer outfalls, but still liable to occasional sewage-pollution by reason of tidal action, suffered from epidemic cholera on a scale of exceptional magnitude, the town of Altona, which practically forms with Hamburg one continuous community, only suffered in a very minor degree, although supplied with water drawn from the same river, and at a point below that at which it is befouled by the sewage of well-nigh 800,000 people resident in Hamburg and Altona. According to Professor Koch, the remarkable immunity of Altona was due to the fact that the Altona water, which was filtered through sand and gravel, was so far freed from the micro-organisms suspended in it by means of the slimy layer of mud, &c., which formed on the surface of the filtering area, as to reduce the risk of mischief to a minimum. The conclusions drawn by Professor Koch from the Hamburg and Altona experience are of such interest and importance that I have reproduced a translation of his report on "Water Filtration and Cholera" in Appendix C. Professor Koch does not claim immunity from infection conveyed by water as the result of any known system of filtration in bulk; on the contrary, he shows that even by the aid of processes carried out with exceptional skill and precautions, every cubic centimetre of water must still be regarded as containing micro-organisms—pathogenic and other—in definite although largely diminished quantity.

Following on a flight from Hamburg, cholera spread to districts immediately around, to localities riparian to the Elbe, and to other portions of Germany. The incidence of the disease along the river water-ways was indeed remarkable; 111 places were attacked along the Elbe, 27 along the Oder, cases followed the track of the Rhine boats, and much the same occurred along the banks of the Weser, the Spree, and the Vistula. Many of the manifestations of cholera in Germany were, however, small in amount. Including isolated attacks 14 counties (Kreise) in all were affected, the total cholera deaths for the period August 16th to November 19th, 1892, reaching 9,563.

The first case of cholera in the United Kingdom was imported into Grangemouth on August 19th. On the 25th two emigrants, who had landed at Leith, sickened in Glasgow; and on September 15th, a fourth case was brought into Grangemouth. All these four cases reached Scotland from Hamburg. Only the first attack was fatal.

(f.) IN GREAT BRITAIN.

1. SCOTLAND.

Cholera reached England on August 25th, and before the end of October 35 cases, of which 11 proved fatal, had been imported. Of the 35 patients 28 reached this country from Hamburg direct, 1 from Hamburg viâ Antwerp, 3 from Antwerp, 2 from Rotterdam, and 1 from Solombola near Archangel. I shall refer later on to the action taken with regard to these cases; and I would only here add that in no instance during 1892 did the disease extend to any person other than those arriving from abroad.

2. ENGLAND AND WALES.

Holland received its first infection from Altona and Hamburg, and in its earlier distribution to the various provinces the disease not only occurred mainly amongst persons whose avocations brought them into relation with shipping, but the lines of diffusion were largely those of river and canal traffic. All the 11 provinces of Holland suffered more or less. Zuidholland, with its ports and river inlets, as also Utrecht in direct communication with these inlets, suffered heavily; whereas Drenthe in the north and Limburg in the south, both inland provinces, had each but a single fatal attack. In all, 293 cholera deaths took place in Holland between August 26th and December 31st.

(g.) IN HOLLAND.

The beginnings of cholera in Austria, which occurred during the early half of September, are involved in some obscurity. By the end of the month the disease had become established in Podgorze and Krakau, and it spread rapidly into other neighbouring departments, and into towns on the Vistula below Krakau. During the months of November and December eastern Galicia was somewhat severely affected as the result of recurring importation from Russia; the places suffering most being mainly situated close to the frontier river Zbrucz, which was at the time frozen over. The disease, however, only acquired epidemic proportions in two Galician towns; whereas in other parts of Austria occurrences of cholera were both sparse and isolated. The total cholera deaths recorded reached 119 by the end of the year.

(h.) IN AUSTRIA-HUNGARY.

In Hungary the incidence of cholera along lines of river traffic was again exemplified by the prevalence of 1892. Buda-Pesth was attacked early in September, the disease appearing amongst workmen unloading hides which had reached the city from Hamburg. Its later diffusion involved no less than 25 counties and 10 municipal towns, a number of the invaded towns and villages being on or near to the banks of the Danube and its tributaries. *The recorded attacks and* deaths up to the close

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of December in Hungary were 2,231 and 1,281 respectively, the cholera death-rate of the invaded districts being 1·75 per 10,000 living. The records for Buda-Pesth, which extend from September 26th, 1892, to February 8th, 1893, include 525 fatal attacks.

(i.) IN THE UNITED STATES OF AMERICA.

The story of cholera in the United States during 1892 is remarkable in more senses than one. Between August 31st and September 16th seven vessels, of which six carried emigrants, arrived in New York, all of the seven coming within the definitions "infected" or "suspected to be infected." Six of the seven hailed from Hamburg, and one from Liverpool. Five of them, all from Hamburg, suffered from cholera during the voyage, 76 deaths, in all, resulting. The first vessel, the "Moravia," arrived at New York having had 22 cholera deaths on board; and this circumstance led to the issue of a Presidential Circular, which, subject to certain limited provisos, inaugurated for vessels carrying emigrants a "quarantine detention of 20 days, and of "such greater number of days as may be fixed in each special "case by the State Authorities." The ultimate result of the Circular was, of course, a suspension of the emigrant traffic; but in the meantime the quarantine of many thousands of persons, nearly all in health, was deemed necessary by the State Authorities; and, as has almost always been the case under such circumstances, the system needed only to be applied in order to break down. The arrangements with a view of carrying it out were of the most rudimentary character, they had to be largely improvised on the spot, and they led to much suffering. And furthermore, the adoption of such measures aroused a spirit of rioting, with resort to arms on the part of the neighbouring population, which had to be quelled by military measures.

But, in the meantime, cholera had succeeded in making its way into the city and State of New York; 16 attacks, including a few suspected cases, with 12 deaths, taking place.

(j.) IN OTHER COUNTRIES.

Minor outbreaks than those to which I have adverted occurred in other countries, including Servia. Isolated attacks of cholera also occurred in Italy, Denmark, Norway, and Morocco. As to these, and to the details generally concerning the wide diffusion of cholera in various parts of the world during 1892, I would refer to Dr. Barry's report, which has been prepared at much pains and with great care.

§ ENGLISH CHOLERA ADMINISTRATION.

ENGLISH CHOLERA ADMINISTRATION.

Throughout the spring and summer careful note had been kept in the Medical Department of the movements of Asiatic Cholera, first in the direction of and across the eastern frontier of Europe into Russia, and then from one Russian province to another in the direction of the Baltic, and of the German and Hungarian frontiers. And, when the disease was evidently about to invade those provinces of Russia which are within the Pale of Settlement

for the Jews, and from which emigration of Russian Jews across Germany and thence to this country was at the time in rapid and continuous progress, it became necessary at once to warn the authorities of those English Ports at which these immigrants and trans-migrants were landing. On the 25th of July a rapid Medical Survey of our ports was commenced, and it was carried on throughout the whole of August, September, and October. The more important of our Eastern Ports were first visited; the next ports to come within the Survey being some on our southern coast.

But in the meantime cholera had reached the Port of Hamburg, the disease having broken out there somewhat after the middle of August. The first intimation of the infection of this port reached the Board on August 23rd, and the circumstance was at once communicated by telegraph to those of our ports which were known to have traffic with the Hanseatic city. The Port Survey, already in progress, was maintained and extended: a large number of ports were visited at various points along our coast line, the Port Authorities being urged, where necessary, to increase their means for the inspection of vessels coming foreign, and to make such arrangements as would enable them to deal with any case of cholera or of choleraic diarrhœa that might be found on board ship. The Survey also took account of a considerable number of Riparian Sanitary Districts, other than Port Districts, the shipping trade of which rendered the adoption of special precautionary measures necessary. In all, more than 100 districts, including all Port Sanitary Districts, were thus visited for the purposes of inspection and conference with the authorities concerned. A list of these districts is appended (Appendix A., No. 13), together with a number of particulars, including the then existing arrangements for dealing with imported cholera; the advice given by the Inspector on behalf of the Board; and, as far as practicable, the action taken at the time on that advice. In this way English Port and Riparian Authorities were placed on the alert; and although 35 cases of cholera reached our shores between August 25th and October 18th the disease, as already stated, in no case extended to any person beyond those who had arrived from abroad. Of these 35 cases, 11 terminated fatally. The vessels by which these cases were imported were 20 in number; they sailed from four different ports, 14 of them coming from Hamburg, and they introduced cholera into 9 English ports. In three instances, cholera succeeded in passing beyond the limits of our Port Districts, the disease not manifesting itself until the persons incubating it had made their way inland. These instances included one passenger who, arriving at Harwich on August 24th, sickened in London on August 27th; four attacks in emigrants who after landing at Hull on August 26th, sickened in Liverpool on August 28th; and two persons who, having landed at Harwich on August 29th, fell ill in London on August 30th. All these seven patients were at once isolated in *hospital; three of them* died and four recovered.

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A number of other precautions were taken by the Board. Amongst these the more important were as follows:—Two Memoranda prepared aforetime in the Medical Department, one entitled "Precautions against the Infection of Cholera," and the other, "General Memorandum on the Proceedings which are advisable "in Places attacked or threatened by Epidemic Disease" (Appendix A., Nos. 14 and 15), were issued on August 26th, 1892, to all Sanitary Authorities and Medical Officers of Health in England and Wales. Special communications were made by the Board to the Managers of the Metropolitan Asylums Board and to the Sanitary Authorities of the Metropolis as to the need of being prepared, in advance, to isolate cases of cholera should that disease extend in the Metropolis. At intervals between July 13th 1892, and 21st January 1893, and as cholera extended from ports in the East and in the Black Sea, &c., to countries on the western coast of Europe, certain Orders prohibiting the landing overside, in ports of this country, of certain classes of rags,* bedding, &c., were issued. On August 29th the Board made Regulations amending Article 12 of their Cholera Regulations of 28th August 1890, thus enabling any Port Medical Officer of Health, with a view to checking the introduction or spread of cholera, to withhold permission to land in the case of such passengers as were "in a "filthy or unwholesome condition," and who were unable to satisfy him as to the addresses to which they were going. And on August 31st further Regulations were issued as to dealing with bilge and tank water in the case of vessels either infected with cholera, or having arrived from a place infected with cholera. These Orders were subsequently consolidated by an amending Order dated 6th September 1892, which will be found in Appendix A., No. 16. Arrangements were also made for the immediate issue, should the necessity arise, of Epidemic Regulations under section 134 of the Public Health Act, 1875, and section 82 of the Public Health (London) Act, 1891.

§ PROPOSALS AS TO QUARANTINE.

PROPOSALS AS TO QUARANTINE.

In the meantime cholera had extended to Ports abutting on the western shores of the North Sea and the British Channel. And under these circumstances, the Board were urged by a number of different Sanitary Authorities and other bodies to take steps which would have involved grave departure from the traditional attitude of England in the face of cholera; an attitude which has been one of the main forces in securing for this country that sanitary administration and those habitual sanitary practices which have won for her the esteem and envy of other nations, and which have been at the root of the greatest saving of life from preventable diseases that has ever been recorded in the history of the world.

* These Orders as to Rags were rescinded in 1893, fresh regulations being prescribed under new Orders dated 5th August 1893 and 13th September 1893 respectively.

The demands had to do with the imposition of quarantine in one or another form. Some authorities couched their requests in terms of a somewhat indefinite character; but others asked definitely to be invested with powers to place in quarantine all vessels arriving from infected ports, and in one instance a period of from four to seven days was suggested for this purpose. And Sanitary Authorities were not alone in pressing such demands. Thus, almost at the same time when one large association of shipowners were making official complaint as to the enormous cost entailed through the enforcement of quarantine in foreign ports—as also at Gibraltar and Malta—against British shipping, other shipping firms were urging that arrivals either from infected ports or from certain specified continental ports should "be quarantined" at all British Ports.

These demands were met by a definite refusal on the part of the Board, but the mere fact that such demands were made calls for serious notice, and this the more because the circumstances under which they were formulated, and which may occur again, gave them for the moment some appearance of reasonableness in the eyes of certain people.

The system of cholera prevention which has been in operation in England for some 40 years, and the details of which have for the past 20 years been largely embodied in the Cholera Regulations issued by the Board, have the following objects in view:—

Port and Riparian Sanitary Authorities have imposed on them the duty of so dealing with ships, either infected with cholera or arriving from places infected with cholera, that the sick shall be placed in hospital; that those suspected of cholera shall be detained for a limited period, so that the nature of their illness may be ascertained; that certain sanitary measures, such as the efficient disinfection of vessels, shall be carried out; and that, prior to the landing of healthy persons, their addresses at the places of destination to which they are travelling shall be obtained.

Should cholera succeed in passing this outer line of defence, the Board trust for the prevention of its spread to the general sanitary administration of the country. Sanitary districts, to which the hitherto healthy passengers are travelling, have communicated to them the addresses of these persons; the system of compulsory notification of infectious disease (very generally in operation) supplies to each local authority immediate means of ascertaining whether any cholera has developed in their district; and, cholera having been discovered within their jurisdiction, Inland Sanitary Authorities have a corresponding duty to that devolving on Port Authorities. That duty can only be properly performed by having at hand means for immediate isolation of the sick and disinfection of their belongings, and by the maintenance of such a standard of wholesomeness as will enable the authority so to deal with any

case of cholera that may reach their district, as to prevent the spread of the disease.

It is not for one moment contended that the system referred to can, with certainty, prevent the importation of any case of cholera into England; indeed, our experience in 1892 shows the contrary. Neither can it be assumed that such a stage has been reached as to free the country from those conditions which are known to favour the spread of imported cholera. But the mere fact of abandoning State quarantine restrictions against cholera, and of devolving on English Sanitary Authorities—port, riparian, and inland—the duty of taking, in their respective districts, the necessary measures of cholera prevention has had an effect the importance and value of which forms a leading chapter in the past sanitary history of England. On the other hand, we have so often seen that when Governments, in their attempt to cope with the risk of imported infection, have drawn lines around their countries—call them quarantine or by any other name—and have said as regards cholera, "Thus far, but no further," a false confidence has been engendered, apathy has taken the place of efficient sanitary administration, and the consequence has been that vigour in quarantine restrictions has nearly always corresponded with laxity in public health administration, and with a high rate of mortality from preventable diseases, often including cholera itself.

It was in 1865 that Sir John Simon definitely set out the attitude which alone was practicable for this country in regard to foreign infection, and that system has since then been in more or less continuous working. During the period in question the general death-rate has gone down from over 23 to a mean of between 19 and 20 per 1,000 living, and a standard of sanitary administration has been attained which, apart from this system, could hardly have been realised. Indeed, the prospect of cholera which, for quarantining countries, has so often served to bring about the substitution of mere measures of restriction for measures of sanitation has in this country been always and intimately associated with progress in the department of public health and of preventive medicine. The result, as regards cholera, is shown in the following table:—

Cholera Mortality.

Date.	England and Wales.		London.	
	Total Cholera Deaths.	Cholera Deaths per Million living.	Total Cholera Deaths.	Cholera Deaths per Million living.
1849	53,293	3,034	14,137	6,182
1854	20,097	1,094	10,738	4,288
1866	14,378	685	5,596	1,842

But, owing to the close inter-relations of cholera and enteric fever in so far as measures of prevention are concerned, we have, in the mortality returns of continued fever in England and Wales, another test of the value of the attitude which has been adopted in this country; and this test has the advantage of indicating with regard to one disease at least what has been our gain quite apart from cholera itself. Since 1869 differentiation has been made in the returns of the Registrar-General between typhus, enteric fever, and "simple and ill-defined fever," the latter term being one the use of which has been rapidly diminishing;* and if enteric fever be grouped with simple and ill-defined fever, we find that whereas the mean annual death-rate per million living from those two diseases was 567 in the five years 1869-73, it was only 179 in the five years 1888-92. If during this latter quinquennium people had died from these fevers at the rate at which they died in the former five-year period there would have been during 1888-92 no less than 55,808 more deaths from "fever" than actually occurred. And, had the same mortality from enteric and ill-defined fever obtained during 1892 which prevailed in 1869, no less than 14,232 persons who at the end of 1892 had escaped death from such fever would have died during that year. In short, if cholera had recurred in England and Wales between 1867 and 1892—a period during which that disease was practically absent from our midst—on the same scale as between 1849 and 1866, we should still be the gainers by several hundreds of thousands of lives. And our gain in this respect is largely due to the incentive given by reason of cholera prospects, and of the knowledge that the disease would have to be met by improved sanitary administration.

But, quite apart from these statistical considerations, it is evident that those bodies who urged a return to quarantine restrictions had failed to adequately apprehend the import of their demands. And it may be well to inquire what would have been the result had it been deemed permissible to comply with certain of these requests.

"Put all ships from infected ports into quarantine" was one demand. Let us apply this to a few only of our ports. Between the end of September 1892 and January 1893 there occurred in Calais some 70 attacks of cholera, of which 24 terminated fatally. The port of Calais was thus an infected port. Between September 24th and December 31st, 1892, cholera was prevalent in Boulogne causing 30 deaths. The port of Boulogne was thus an infected port. Now in the six weeks ending November 12th, 1892, the mean weekly number of passengers arriving at Dover from the port of Calais was 1,800, and if a quarantine

* In 1869 the number of deaths in England and Wales attributed to "simple and ill-defined fever" was 5,310; in 1892 it was 244. Whilst much of this diminution must be regarded as due to a transference of deaths from the undefined to the enteric fever group, yet it is by no means assumed that the whole diminution can be thus accounted for.

of five days had been imposed on arrivals from this infected port, the total number of persons who would have had to be detained, housed, fed, and otherwise cared for, either afloat or on shore, by the Dover Sanitary Authority, would, apart from the crews of the vessels, have amounted to 10,804; the number under detention at any one time ranging from 1,019 to 1,723. Dealing with Folkestone in the same way, it appears that during the six weeks ending November 12th, 1892, the total number of passengers arriving there from the infected port of Boulogne was 3,251; that the mean weekly number of arrivals was 543;* and that the number of persons who at any one time would have had to be detained at Folkestone under a five days' quarantine system would have ranged from 272 to 623.† And, owing to cholera at other ports, such as Dieppe and Havre, similar measures would have had to be carried out at other English ports, notably at Newhaven and Southampton. Apart, indeed, from an almost complete cessation of traffic between the ports concerned, such as might have been brought about by any real attempt at quarantine restrictions, the result attained would have been one which could only have brought ridicule on our sanitary administration.

Some, it is true, allege that arrivals from ports such as those referred to would necessarily have to be exempted from any general rule as to quarantine, for the reason that the sea voyage in question constitutes so small a part of that which should properly be regarded as an almost uninterrupted railway journey between the capitals of the countries concerned. I entirely agree: the system would break down on its first application unless exemptions were brought in. But the moment exemptions are introduced it would be almost impossible to say where they are to stop; and it is certain that they at once introduce deliberately and in wholesale form, that very element of "leakiness" which, as Sir John Simon has shown, condemns the quarantine system itself.

But some authorities, having regard mainly to the magnitude of the epidemic in Hamburg, limited their demands for quarantine to arrivals from that port. As to this, I would observe in the first place, it soon became evident that there was little or no need to place quarantine restrictions on Hamburg, for, with the diffusion of cholera in that city, its shipping trade came almost to a standstill. And further, travellers from Hamburg to this and other countries, fearing lest they might be subjected to certain inconvenient restrictions, made other ports than Hamburg their immediate point of departure. Thus, those who journeyed

* These figures take no account of excursion traffic between the ports in question.

† For the statistics as to the amount of passenger traffic reaching Dover and Folkestone I am indebted to Mr. William Forbes, of the London, Chatham, and Dover Railway Company, and Sir Myles Fenton, of the South-Eastern Railway Company. The actual number of passengers was less than usual, owing to the prevalence of cholera on the continent of Europe.

to England took ship at Dutch, Belgian, and even French ports; and it became obvious that irksome restrictions placed on arrivals from any one of the ports concerned, whether German, French, or other, would at once have led to a diversion of the traffic, and that any approach to successful quarantine against even a single port could only have been carried out at the cost of a general system of quarantine against all the principal ports on the western littoral of the continent of Europe. And further, any such action would necessarily have involved goods as well as passengers. Indeed, some who urged these demands on the Board did not fail to extend their application to many classes of goods and merchandise, and notably to food supplies.

In brief, return to quarantine restrictions on the part of this country could, even at this date, hardly fail to have a most injurious effect in retarding sanitary progress; and the effort to make the system in any way effectual would lead to the application of restrictions on people and on commerce that would be altogether intolerable. And after all, a really rigid quarantine, as applied to this country, must needs fail in important measure to effect the objects which its promoters would have in view. Writing in his annual report for 1865, Sir John Simon concluded thus:—"So, for England, under present circumstances, quaran-" tine against cholera, as existing in countries which are nearest " to us, is a precaution of which there can be no serious thought. " Were the country ever so ready to endure those extreme " restrictions without which the whole thing is fruitless and " absurd, the means for imposing them do not exist." These and other weighty words which Sir John Simon set out, in then dealing with this subject, evidently need to be recalled. They are reproduced in Appendix A., No. 17; and it may be said that, if possible, they are even more applicable to the present circumstances of England than they were to those which obtained when they were written some thirty years ago.

III.—INTERNATIONAL SANITARY CONFERENCE OF VENICE.

In January 1892 an International Sanitary Conference was held in Venice. The principal objects of this Conference as set out in a Protocol of an arrangement between the Marquess of Salisbury on the part of Great Britain, and Count Deym on the part of Austria-Hungary, were concerned with obtaining a diminution in the quarantine restrictions imposed on vessels passing from the Far East into the basin of the Mediterranean; with securing for certain classes of suspected or infected vessels that they should be free to pass the Suez Canal "in quarantine"; and with the reconstitution of the Maritime, Sanitary, and Quarantine Board of Alexandria. The British delegates to the Conference were Mr. J. W. Lowther, M.P., Under-Secretary of State for Foreign Affairs, and Dr. Mackie, C.M.G., delegate to

the Alexandria Board; and Mr. H. Farnall, C.M.G., of the Foreign Office, acted as Secretary. In the end the Protocol referred to was discarded as a basis for the deliberations of the Conference, but the principles formulated in it were largely accepted, and its main objects were to a considerable extent attained. One very prominent gain for this country was that restrictions on vessels were for the future to be directed against actual disease amongst those on board ship rather than on a "constructive contamination according to the health of the port "of departure."

This Conference was the fifth International gathering which had met for the purposes of controlling the spread of cholera from Asia into Europe. The first was held in Paris in 1852, the second at Constantinople in 1866, the third at Vienna in 1874, and the fourth at Rome in 1885. On each of these four occasions progressive diminution in quarantine restrictions was proposed, but the proposals always fell far short of that which was regarded as either sufficient or reasonable by Great Britain, and no such agreement could be come to as would admit of the Conclusions which were arrived at being embodied in an International Convention. But at Venice it was different. On January 30th, 1892, the delegates of the majority of the Powers present signed a Convention embodying the Conclusions of the Conference.

Objection was, however, taken by Her Majesty's Government to certain provisions embodied in the Convention, and notably to one relating "to the detention in a lazaretto of healthy "persons on the alleged ground that they had been in contact "with the sick"; the result being that the British Delegates were not authorised to sign the instrument. But, later on, it was decided that an effort should be made, by means of a meeting between representatives of the Austro-Hungarian, French, and British Governments, to settle the differences which prevented the acceptance by England of the Convention signed at Venice. And as the result, a meeting was convened in Paris, at which, at the desire of the Marquess of Salisbury, and with the Board's sanction, I acted as British Technical Delegate. My colleague on behalf of Great Britain was Mr. Constantine Phipps, C.B., of Her Majesty's Embassy in Paris; and the other delegates were Monsieur Barrère, Minister of the French Republic at the Court of Bavaria, Prof. Brouardel and Prof. Proust on behalf of France; and Count Kuefstein on behalf of Austria-Hungary.

We met on May 19th, 1892, and after a series of sittings we signed on June 9th a Procès-Verbal embodying a series of modifications in the Convention. The modifications effected are shown in Appendix A, No. 18, by means of a table so arranged in parallel columns as to contrast the results of the Venice and the Paris sittings of this Conference. A translation of the Procès-Verbal adopted in Paris is also appended.

It only remains to be stated that all the European Powers who signed the Convention at Venice assented to the modifications made at the Paris sittings, and that the Venice Convention came into operation on November 1st, 1893.

IV.—AUXILIARY SCIENTIFIC INVESTIGATIONS.

THE MICRO-PATHOLOGY OF ENTERIC FEVER.

Dr. Klein, in continuation of his study of the etiology of infectious diseases, has extended his observations to enteric (typhoid) fever, and during the year has been able to make bacteriological observation of a considerable number of cases of this disease. His object has been to ascertain what are the relations of the so-called "Typhoid bacillus" to the tissues of the bodies of persons the subjects of enteric fever; and further to discover in what way or ways this micro-organism, provisionally accepted by many observers as the particulate cause of enteric fever, may be distinguished from similar or allied forms (Appendix B., No. 1.)

As regards the tissues of the living enteric-fever patient, Dr. Klein was able to examine the blood alone. From this tissue he did not obtain the bacillus in question, notwithstanding that he sought for it diligently at various stages of the malady, both in coverglass specimens of blood samples and by culture of blood samples in a great variety of nutrient media. In certain tissues of the bodies, however, of persons dead of the disease he never failed to find it; sparingly and occasionally only in the blood, but abundantly and uniformly in the mesenteric glands and in the spleen. In these last-named tissues, moreover, the bacillus was existing always in a condition allowing of its ready and indefinite multiplication. Furthermore he rarely, at any stage of the fever, obtained from the above tissues, in a condition capable of retaining their vitality, any of the other bacteria which commonly inhabit the intestine of enteric-fever patients; whereas even at an early stage of the fever, and antecedent therefore to ulcerative processes in the intestinal mucous membrane, he found the "typhoid bacillus" flourishing in the spleen and mesenteric glands, often in pure culture. For the above reasons, as also from the circumstance that at the stage of the fever when ulceration of the intestines has become fully established, the micro-organism in question, instead of increasing, tends to diminish in and to disappear from the mesenteric glands and from the spleen, Dr. Klein is disposed to regard this bacillus as more likely to be the cause than a consequence of enteric fever.

With reference to the distinguishing features of this "typhoid bacillus," Dr. Klein, after close study of the microbe, under repeated subculture, when he had obtained it directly from the tissues in the acute stages of enteric fever, recognises its likeness in certain respects—under parallel conditions of observation in subculture—to bacillus coli communis taken from the contents of the small intestine of the healthy human subject; but

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nevertheless he holds very strongly that it is a separate and distinct species. For differentiation of the two organisms under the above conditions of comparison he relies on the following observed points of dissimilarity. Morphologically the "typhoid bacillus" is longer than bacillus coli, at the same time that it is more actively motile; while culturally the two organisms differ even more widely. Grown as a "shake" culture in beef broth gelatine, the "typhoid bacillus" does not, whereas bacillus coli always does, form gas bubbles; grown in milk it does not, like bacillus coli, curdle that fluid; and grown in faintly alkaline beef broth to which nitric acid is subsequently added, it does not, like bacillus coli, afford the indol-reaction. Once only—and this in a stage of enteric fever corresponding to convalescence from the disease—did Dr. Klein obtain from the mesenteric glands and spleen of the dead body a bacillus which corresponding in one sense to the "typhoid bacillus" in others to bacillus coli, could not by the above tests be distinguished with certainty from either microbe.

For the rest, Dr. Klein, while provisionally accepting the "typhoid bacillus" as the essential cause of enteric fever, incidentally notes directions in which it does not fulfil all the conditions demanded by some authorities of the living particulate cause of this disease. In no circumstances of artificial culture has Dr. Klein found it capable of producing spores; so that the observed prolonged vitality of the infection of enteric fever outside the animal body, in sewage, in water, and in the soil, may appear to some etiologists as without sufficient explanation. Those, too, who require that the typhoid-fever bacillus, when experimentally introduced into the bodies of rodents, shall produce in these animals disease of the nature of typhoid fever, will be discontented with Dr. Klein's results in this sense. Dr. Klein is able indeed to induce illness and death of rodents by injection into them of cultures of the "typhoid bacillus;" but the induced malady is regarded by him as a mere septicæmia, identical with that easily brought about in these animals by injection of various and dissimilar microbes.

PROTECTIVE INOCULATIONS. *a.*) General Considerations.

Proceeding further with his study of the influence upon each other's life processes of different bacteria introduced simultaneously, or in sequence, into the animal body (Appendix B., No. 2), Dr. Klein has found reason for insisting on distinction between an influence due to the actual chemical constituents of a given microbe, and an influence, on the other hand, referable to the chemical products wrought by it in the pabulum in which it flourishes. He notes for instance that the bodies—*protoplasm*—per se of certain bacteria have when inoculated into rodents a particular physiological effect, whereas the culture media in which the bacteria have multiplied and grown, and from which they themselves have been completely removed, have, under like conditions, other and different physiological effect. Both effects Dr. Klein regards as due to a poisonous quality of the material

inoculated; and the deleterious substance found to be bound up within the body of the bacterium he would call the "intra-cellular" poison, that manufactured and retained in the culture medium, the "metabolic" poison, of the particular microbe under investigation.

Upon this basis of differentiation of a microbe from its products Dr. Klein went on to enquire whether the observed insusceptibility to one and other infection, conferred on an experimental animal by a so-called protective inoculation, is to be referred to mere multiplication and accumulation within that animal of the protoplasm (with its included poison) of the microbe that has been inoculated, or is due to chemical substances (of a poisonous nature) manufactured so to speak by that microbe from out the tissues of the animal in question. And with this surprising result:—

Working with a number of dissimilar microbes he found that each and all of them, when their intra-cellular substance (whether living or dead) was introduced into guinea-pigs, produced in these animals one and the same malady. Also he found that guinea-pigs made ill (short of death) in the above fashion by inoculation with the intra-cellular poison of one of his microbes were fully protected against further successful inoculation with the intra-cellular poison of any of his other microbes, and this notwithstanding that such secondary inoculations were made with greater amount of (as well as more potent) intra-cellular poison than had been employed as matter of first instance.

(*b.*) In respect o cholera.

Applying the knowledge thus obtained to a strict examination of the value as a protection against cholera of the anti-cholera inoculations that are now being practised, he points out that the essence of these procedures is inoculation into the body to be protected of the cholera vibrio itself, not of the chemical products resulting from its life processes; and he goes on to show, experiment by experiment, that though inoculation into the animal body of the intra-cellular poison (whether living or dead) of the cholera vibrio does indeed protect that body against further reaction to the same test, this vibrio has not monopoly of protection in this sense. Insusceptibility to a so-called *virus-fort* (namely, intensified intra-cellular poison) of the cholera microbe is, he demonstrates, equally well obtained by inoculation of the living or dead intra-cellular substance of a great variety of microbes.

He contends moreover that the malady induced in his experiments indifferently by inoculation of the intra-cellular poison of the vibrio of cholera, of the vibrio of Finkler, of bacillus prodigiosus, of proteus vulgaris, of bacillus coli, of the bacillus of enteric fever, or of staphylococcus aureus cannot, in view of the above dissimilar sources of infection, be thought of as in any sense specific, or as the equivalent or substitute for definite attack of cholera.

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In so far indeed as the malady thus induced in the guinea-pig results from poisoning by the cholera vibrio per se, the facts in our possession respecting the micro-pathology of cholera suffice, he holds, to indicate its entire independence of that disease. The cholera vibrio, he points out, like the microbe of diphtheria, does not in the human subject—as does, for example, the anthrax bacillus—range throughout the system of the person attacked. Neither bacillus diphtheriæ nor Koch's comma bacillus is disseminated in the tissues of the body. Each is strictly localised in the subject of the disease; and, as certainly with diphtheria, so also provisionally with cholera, we have to regard the poison upon which the disease depends as a metabolic product locally manufactured in the animal body by the life processes of the one or the other microbe—a poison which becomes absorbed, apart from the agent producing it, into the system of the person attacked. In Dr. Klein's view therefore anti-cholera inoculation as now practised cannot be expected to have protective value.

VARIOLA AND VACCINIA.

Renewal of small-pox prevalence in London in the spring of 1892, after an interval of several years during which the disease had remained well nigh absent from the metropolis, served, in connection with Dr. Klein's study of the etiology of variola and vaccinia, as occasion for renewal also of experimental testing by him of the inter-relations of these maladies. (Appendix B., No. 3.) At this time, too, accounts were reaching us from the Continent of Europe and elsewhere, tending to suggest that transference of variola from the human to the bovine animal—with a view to modification of the general disease variola into the local malady vaccinia, such as had been obtained in the past by Ceely, Badcock, and others—might be undertaken afresh with better hope of success, if calves were substituted as the bovine recipients of the transferred infection, for the milch cows and heifers which heretofore had been chiefly employed in experiments of this nature.

Dr. Klein, therefore, having procured at the Hospital Ships in Long Reach lymph from the early vesicles of typical cases of confluent small-pox, proceeded to inoculate this small-pox matter, by linear cutaneous incisions, into calves. His first experiment in this direction proved a failure; but on a second attempt he succeeded in obtaining a local result in the groin of a calf thus inoculated. This local result, however, was in no way characteristic of "vaccinia." It consisted, on the fifth day, of nothing more than an appearance, as regarded some only of the 24 incisions into which small-pox lymph had been introduced, of a linear crust at the site of the incision, with swelling of the skin in its neighbourhood and distinct areolar redness At no time was there in this calf any trace of vesicle. Nevertheless, Dr. Klein, by clamping and scraping these quasi-successful incisions, was able to obtain from them material for transference to a second calf, in which by the fifth day precisely similar results were produced. This *second* calf furnished in due course material

for inoculation of a *third*, which in turn served for inoculation of a *fourth* calf. In each animal of the series the local results were in the main identical; in none was there any appearance whatever of vesiculation. So far as the results obtained in later calves of the series departed from the results obtained in earlier calves, the difference was only in the direction of greater degree of local manifestation; as for instance, greater swelling of skin about the incisions and more defined areola, with tendency also perhaps to larger amount of insertion success.

At the stage now reached, the fourth remove from the small-pox patient, it was considered by Doctors Klein and Cory (who in this matter acted in concert) that semi-fluid material, now to be squeezed out without difficulty from the insertions which had "taken" in the sense above described, might with safety be transferred to the human subject. Accordingly, material obtained on the seventh day from certain incisions of the fourth calf of the series was introduced by Dr. Cory by five separate insertions into the arm of an infant, and with complete success. The arm of this infant presented on the eighth day appearances characteristic of vaccinia. Moreover, the course of the vaccinia in the baby in question (for vaccinia it undoubtedly was in the opinion of Dr. Cory, who kept the case under observation throughout) proceeded from first to last in perfectly orthodox fashion.

Having thus obtained by passing small-pox matter through the calf, a lymph which in its effects on the human subject proved indistinguishable from lymph of vaccinia, Dr. Klein sought to ascertain whether by transferring this lymph back from the human subject to the bovine animal, complete manifestation of vaccinia in the latter could be at once obtained, as is customary in the case of ordinary retro-vaccination. He, therefore, secured one of the scabs which had fallen in due course from the arm of the baby vaccinated by Dr. Cory with the lymph of variolous pedigree, and having mashed up this scab in sterile salt solution, applied the mixture to multiple cutaneous incisions in the groin and abdomen of another (a fifth) calf. As a result, he obtained by the sixth day, and in 50 per cent. of his incisions, results not to be distinguished from that current in the calves vaccinated at the Animal Vaccine Establishment; and further, lymph taken in turn from this retro-vaccinated calf and inserted indifferently into other calves and into the arms of infants, produced alike in the bovine and human subject *typical vaccinia*. Finally, as a conclusion to this series of experiments, Dr. Klein after lapse of six weeks submitted this retro-vaccinated calf and the calves vaccinated from it to the test of a further and thorough vaccination with current calf-lymph; and with the result that all these animals entirely resisted vaccinia.

Now it so happened that while these experiments of Dr. Klein were in progress the Board received from Dr. Simpson, the Medical Officer of Health of Calcutta, two samples of lymph which afforded convenient opportunity for checking the results

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that were being obtained by Dr. Klein. Dr. Simpson had it, seems, been experimenting on precisely similar lines. He had obtained lymph from the vesicles of a small-pox patient on the fifth day of eruption, had passed this small-pox lymph (as had Dr. Klein) through two or more calves, had then transferred the lymph by in-vaccination of their arms through one or more children, and from these children had re-transferred it again to calves. It was lymph from calves thus so to speak retro-vaccinated that Dr. Simpson forwarded from Calcutta, and both his samples were accordingly handed to Dr. Klein. The result of Dr. Klein's testing of this Calcutta lymph proved altogether confirmatory of his own recent experience. On receiving Dr. Simpson's samples he inserted each separately into multiple incisions of the groins and abdomens of different calves. By the fifth or sixth day both calves exhibited typical vaccinia; the only observed difference between the two animals being that in one the induced vaccinia was retarded somewhat as compared with the other. Lymph taken on the sixth and seventh days from the calf in which the process had been least retarded was now used for insertion (by Doctors Klein and Cory respectively) into another calf and into the arms of three infants. As a result both calf and infants presented at due time typical vaccinia. The three infants afforded on the eighth day lymph for other five babies, and these like their vaccinifers passed through their vaccination without any sort of abnormality or complication. In the end both calves which in the first instance had been made recipients of Dr. Simpson's samples of lymph were subjected to further vaccination; but, as in the case of Dr. Klein's own series, an attempt to vaccinate them failed entirely.

BACTERIOLOGY OF LYMPH, BOVINE AND HUMAN.

Dr. Klein's other study during the year of the etiology of vaccinia and variola has had concern with the bacteriology of lymph from the one and the other source, and has been especially addressed to discovery in these lymphs of the microbe of the one and the other disease. In his search in the latter direction he derived some assistance from the following considerations. On the one hand he had in mind the well-known fact that lymph collected from the ripe vaccine vesicle and *thoroughly dried* on points can retain its activity for a great length of time. On the other hand, his own experience had told him that lymph taken in a very early stage of the vaccine vesicle, though fully potent for calf-to-calf vaccination, is comparative useless when dried and stored. Regard for both these considerations led him to suspect that the superior activity after drying of late lymph might be due to spore condition of the vaccine principle contained in it, and the inferior activity of dried *early* lymph to the circumstance that spores had not yet been formed therein at the date of its collection. Hence he determined to examine the nascent vaccine vesicle with a view to the more likely detection of the hypothetical microbe of vaccine resident in the contained lymph of such vesicle.

Dealing first with vaccinia in the calf, Dr. Klein found that lymph taken from the budding vesicle at the third and fourth day of vaccination contained, on examination in coverglass specimens stained in alcoholic gentian violet, a minute bacillus in abundance and almost in pure culture. This bacillus has definite morphological features, and contains always a spherical or slightly oval globule that Dr. Klein makes no doubt is a spore. In lymph taken from the calf on the fifth day the same bacillus is present but in far less number than in the earlier lymph; in late lymph (sixth or eighth day) this bacillus is scarce, and seems to be replaced by granules taking the fuchsin stain, granules which Dr. Klein suspects to be spores of the bacillus escaped from their bacillary envelopes. The presence of this bacillus at the very earliest stage of vaccinia in which lymph is procurable from the calf, and in amount far in excess of any other micro-organism, seemed to Dr. Klein to indicate that this microbe is not an adventitious saprophytic organism; and this view obtains corroboration from the circumstance that Dr. Klein's attempts to cultivate the bacillus (or its spores) in a great variety of artificial media failed in every instance. This failure of the bacillus to grow outside the animal body was the greater misfortune since it has thus far prevented study by Dr. Klein of its ability by itself to produce vaccinia.

Having made himself familiar with the morphology of this microbe of calf lymph, Dr. Klein next proceeded to examination, by the same methods, of lymph from vaccine vesicles in the human subject. In this lymph he found likewise a bacillus corresponding in all respects, so far as he was able to test it, with that found in calf lymph. And, finally, from lymph of the vesicles of small-pox patients he obtained a bacillus in no way to be differentiated by the means at his disposal from that found alike in vaccine lymph from bovine and human sources.

As with the bacillus of calf lymph, so also with the bacilli from human vaccinia and from small-pox, by no condition that he was able to contrive could Dr. Klein get these organisms to grow outside the animal body in artificial culture media. Until, therefore, these difficulties are overcome, he is greatly hindered in further study of these very interesting and perhaps highly important micro-organisms.

STUDY OF MICRO-ORGANISMS OF HUMAN INTESTINE.

Among the micro-organisms—bacilli, moulds, sarcinæ, cocci—normally inhabiting the small intestine of man, the bacillus coli communis especially deserves attention. Not only does it seemingly exist indifferently in the intestine of man and other animals, and as well in various media outside the animal body, but it bears in certain respects (as has been already noted) so close a resemblance to the so-called enteric-fever bacillus as to be frequently confused with that organism. Dr. Cautley during 1892–93 has made investigation of this bacillus obtained by him for the most part from the human subject. (Appendix B.,

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No. 4.) Examining the contents of the small intestine taken from bodies of persons whose death had resulted from a great variety of diseases, he always finds this bacillus, and finds it usually in far greater abundance than any other organism. He has thus had opportunity of studying, morphologically and culturally in a great variety of media, samples of this bacillus from many separate sources, and his work in this sense has already proved of service, as forming the basis for Dr. Klein's differentiation of the "typhoid bacillus" which is recorded in another paper of this volume.

Like other observers, Dr. Cautley does not find the bacillus coli presenting invariably strictly definable morphological characters. These tend to vary somewhat in his experiments according to the sources whence the bacillus has been derived, and according also to the culture medium in which it has been grown. Nevertheless, Dr. Cautley is disposed to include all these observed variations within the limits of a single species, and he, like Dr. Klein, makes definite distinction between bacillus coli and the "typhoid bacillus."

SEPTICÆMIA.

In reference to septicæmic processes, Dr. Andrewes has made examination of the ability of one and another microbe to cause septicæmia in rodents, according as it has or has not been associated with the latter process in the human subject. (Appendix B., No. 5.) Streptococci of two sources were thus tested by him. The one streptococcus, obtained from the heart-blood of a person who had died from perforation of the bowel during an attack of enteric fever, induced in rodents, but uncertainly, septicæmia of a comparatively mild sort; the other streptococcus obtained from the pus of a cerebral abscess which had proved fatal to the subject of it failed to induce septicæmia in these animals, but produced instead chronic abscess at the point of inoculation. With two species of bacillus, the "typhoid bacillus" and the bacillus coli, derived from the human subject, Dr. Andrewes also failed to produce in rabbits any definite blood infection. But the result to rodents was altogether different when he used for experimental infection of these animals bacilli of two sorts, bearing resemblance, the one to bacillus coli, the other to the "typhoid bacillus," and both of which had been obtained from the septicæmic fluids of guinea-pigs. These bacilli invariably produced, on subcutaneous inoculation into rodents, intense and usually quickly fatal septicæmia.

CHEMICAL PATHOLOGY.

Dr. Martin's investigation of the Chemical Pathology of Infectious Diseases has in 1892–93 been extended to tetanus. During the year he has found opportunity for closely observing in the above sense eight cases of this malady; but the experimental procedures adopted by him in regard of the material obtained from the cases in question are not yet sufficiently far advanced to enable him to report in detail on the subject. Meanwhile, therefore, he submits (Appendix B., No. 6) a paper

in further consideration of the results of his previous research into diphtheria, in their bearing on the symptoms exhibited by those suffering from that disease.

I have the honour to be,
Sir,
Your obedient Servant,
R. THORNE THORNE.

May 1894.

APPENDICES.

APPENDIX A.

No. 1.

DIGEST of the VACCINATION OFFICERS' RETURNS, with regard to CHILDREN whose BIRTHS were registered in the Year 1890.

THE following is the nineteenth annual return under the Vaccination Act, 1871. Of 875,188 births returned to the Board by the several Vaccination Officers in England and Wales as registered during the year 1890, the number which at the time the return was made had been registered as successfully vaccinated was 682,560. This number is 78·0 per cent. of the whole. The children whose births were registered during the year, and who were not recorded as successfully vaccinated, numbered 192,628. Of this number, 91,768 were registered as having died unvaccinated. Out of the same number, 1,672 had been registered as insusceptible of vaccination; 2 as having contracted small-pox and, therefore, not needing to be vaccinated; 13,615 as having their vaccination postponed by medical certificate; and there remained on the Vaccination Officers' registers 85,571 children born in 1890, who had "removed," were "not to be traced," or were otherwise unaccounted for. If from the 875,188 births returned by these officers deduction of the deaths without vaccination be first made, it appears that of the remaining 783,420 children, there were registered at the time of the return 87·1 per cent. as successfully vaccinated; 0·2 per cent. as either insusceptible of vaccination, or as having had small-pox; and 1·7 per cent. as under medical certificate of postponement; leaving 10·9 per cent. as at that time still unaccounted for as regards vaccination.

The per-centage of children not finally accounted for as regards vaccination (*i.e.*, including cases postponed) was 11·3 of the total births (875,188); and this figure is given in the Summary of Returns, in sequence to the records of former years.

By the latter method of computation, it appears that the proportion of cases not finally accounted for in the metropolitan returns for 1890 was 13·9 per cent.; in the provincial returns, 10·9. Of the registered

App. A. No. 1.

Digest of Vaccination Officers' Returns, 1890.

births of the nineteen years 1872–90, the corresponding proportion not finally accounted for in regard to vaccination in each year respectively has been as follows:—

—	Metropolis.	Rest of England.	—	Metropolis.	Rest of England.
1872	8·8	4·5	1882	6·6	4·5
1873	8·7	4·2	1883	6·5	4·9
1874	8·8	4·1	1884	6·8	5·3
1875	9·3	3·8	1885	7·0	5·5
1876	6·5	4·0	1886	7·8	6·1
1877	7·1	4·1	1887	9·0	6·7
1878	7·1	4·3	1888	10·3	8·2
1879	7·8	4·5	1889	11·6	9·6
1880	7·0	4·5	1890	13·9	10·9
1881	5·7	4·3			

In 1890 the proportion of cases unaccounted for, after deduction of the postponed cases, in the metropolis and in the rest of England, was 12·2 and 9·4 per cent. respectively.

	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
ENGLAND & WALES -	875,188	682,560	1,672	2	91,768	13,615	85,571	11·3
Ditto (excluding Metropolitan Unions).	746,963	585,706	1,249	1	78,635	11,496	69,876	10·9
Metropolitan Unions -	128,225	96,854	423	1	13,133	2,119	15,695	13·9
COUNTIES.								
England:								
Bedford - - -	4,598	2,690	7	—	521	74	1,306	30·0
Berks - - -	7,173	6,193	4	—	578	98	300	5·5
Bucks - - -	4,529	3,920	10	—	394	59	146	4·5
Cambridge - -	5,305	4,570	3	—	474	89	169	4·9
Chester - - -	20,706	17,517	28	—	2,196	252	715	4·7
Cornwall - - -	8,476	6,569	3	—	988	144	772	10·8
Cumberland - -	8,440	6,984	6	—	951	205	394	7·1
Derby - - -	13,196	10,547	10	—	1,251	201	1,187	10·5
Devon - - -	16,894	14,207	19	—	1,512	345	811	6 8
Dorset - - -	4,790	4,080	6	—	303	52	349	8·4
Durham - - -	36,968	29,274	58	—	4,184	579	2,873	9·3
Essex - - -	23,271	18,489	68	—	2,047	569	2,098	11·5
Gloucester - -	20,340	15,434	41	—	1,973	449	2,443	14·2
Hereford - - -	2,995	2,570	3	—	245	66	111	5·9
Herts - - -	6,963	5,601	9	—	552	71	729	11·5
Hunts - - -	1,309	1,152	4	—	102	17	34	3·9
Kent (extra-metrop.) -	22,100	17,791	44	—	2,031	490	1,694	9·9
Lancaster - -	126,727	97,838	261	—	15,065	1,938	11,625	10·7
Leicester - - -	11,736	3,832	6	—	1,687	67	6,144	53 9
Lincoln - - -	12,937	10,720	22	—	1,396	276	523	6·2
Middlesex (ex.-metro.)	15,237	12,038	59	—	1,346	168	1,626	11·8
Monmouth - -	9,245	7,694	5	—	938	200	408	6·6
Norfolk - - -	13,032	10,167	16	—	1,412	164	1,273	11·0
Northampton - -	8,933	3,970	2	—	1,065	118	3,778	43·6
Northumberland -	16,528	13,219	19	—	1,899	527	864	8·4
Nottingham - -	15,739	12,306	25	—	1,678	205	1,525	11·0
Oxford - - -	5,182	4,145	9	—	473	77	478	10·7

	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
COUNTIES—*cont.*								
England—*cont.*								
Rutland	520	457	—	—	30	6	18	4·6
Salop	6,856	6,010	7	—	564	79	196	4·0
Somerset	14,109	10,861	30	—	1,312	283	1,623	13·5
Southampton	17,980	15,237	17	—	1,410	242	1·074	7·3
Stafford	32,351	26,272	54	—	3,718	383	1,924	7·1
Suffolk	9,979	8,389	5	—	801	189	595	7·9
Surrey (extra-metro.)	14,522	11,345	26	—	1,079	219	1,853	14·3
Sussex	13,469	10,651	25	—	1,089	262	1,442	12·7
Warwick	24,072	19,472	47	—	2,738	255	1,560	7·5
Westmorland	1,719	1,548	2	—	126	18	25	2·5
Wilts	7,001	5,961	4	—	509	118	409	7·5
Worcester	18,092	15,397	44	1	1,895	160	595	4·2
York, East Riding	12,119	9,956	37	—	1,276	100	740	6·9
York, North Riding	10,946	8,883	7	—	1,229	230	597	7·6
York, West Riding	73,615	52,301	168	—	8,930	712	11,504	16·6
Wales:								
Anglesey	801	692	—	—	80	6	23	3·6
Brecknock	1,530	1,307	—	—	145	20	64	5·5
Cardigan	1,583	1,375	—	—	140	24	44	4·3
Carmarthen	4,045	3,602	—	—	368	24	51	1·9
Carnarvon	3,041	2,619	2	—	282	67	71	4·5
Denbigh	2,604	2,179	1	—	265	67	92	6·1
Flint	2,232	1,930	—	—	191	40	71	5·0
Glamorgan	22,240	20,485	22	—	2,647	370	725	4·5
Merioneth	1,723	1,484	2	—	171	39	27	3·8
Montgomery	1,694	1,473	1	—	159	24	37	3·6
Pembroke	2,304	1,930	1	—	226	47	100	6·4
Radnor	451	364	—	—	35	12	40	11·5

METROPOLITAN UNIONS.	RETURNS, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
Bethnal Green	4,736	2,717	6	1	563	39	1,410	30·6
Camberwell	7,152	5,408	17	—	729	226	772	14·0
Chelsea	2,711	2,228	1	—	311	17	154	6·3
Fulham	5,876	4,865	35	—	584	45	347	6·7
George, St., Hanover Sq.	3,014	2,636	10	—	258	17	93	3·6
George, St., in the East	1,909	1,435	4	—	227	4	139	7·9
Giles, St., and St. George	1,153	818	3	—	127	5	200	17·8
Greenwich	5,271	3,004	13	—	552	277	1,425	32·3
Hackney	6,629	4,235	23	—	645	44	1,682	26·0
Hampstead	1,477	1,254	15	—	115	16	77	6·3
Holborn	4,986	3,804	5	—	559	58	560	12·4
Islington	9,239	7,250	19	—	1,117	122	731	9·2
Kensington	3,788	3,160	16	—	324	33	255	7·6
Lambeth	8,857	6,370	29	—	990	144	1,124	14·3
Lewisham	2,280	1,937	16	—	183	17	127	6·3
London, City of	746	603	1	—	65	8	69	10·3
Marylebone	4,364	3,643	3	—	382	67	269	7·7
Mile End Old Town	4,045	2,638	24	—	311	112	960	26·5
Olave, St.	4,813	3,590	12	—	516	118	597	14·8
Paddington	2,845	2,255	7	—	254	29	300	11·6
Pancras, St.	6,953	5,237	42	—	623	118	933	15·1
Poplar	5,813	4,057	38	—	583	33	1,102	19·5
Saviour, St.	6,823	5,256	19	—	756	77	715	11·6
Shoreditch	4,374	3,450	5	—	514	54	351	9·3
Stepney	1,851	1,417	8	—	203	3	220	12·0
Strand	505	391	—	—	78	6	30	7·1
Wandsworth and Clapham	9,038	6,953	44	—	894	364	803	12·9
Westminster	871	654	—	—	102	42	73	13·2
Whitechapel	2,748	2,434	1	—	239	—	74	2·7
Woolwich	3,438	2,975	7	—	329	24	103	3·7
	128,225	96,854	423	1	13,133	2,119	15,695	13·9

APP. A. No. 1.

Digest of Vaccination Officers' Returns, 1890.

	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
BEDFORD.								
Ampthill	406	353	—	—	33	3	17	4·9
Bedford	1,294	984	4	—	118	54	134	14·5
Biggleswade	759	542	1	—	89	7	120	16·7
Leighton Buzzard	529	432	2	—	64	4	27	5·9
Luton	1,364	176	—	—	199	5	984	72·5
Woburn	246	203	—	—	18	1	24	10·2
BERKS.								
Abingdon	557	504	—	—	35	6	12	3·2
Bradfield	450	399	—	—	35	3	13	3·6
Cookham	577	515	—	—	36	6	20	4·5
Easthampstead	323	285	—	—	28	—	10	3·1
Faringdon	359	271	—	—	34	11	23	10·0
Hungerford	469	426	1	—	36	3	3	1·3
Newbury	590	493	—	—	58	15	24	6·6
Reading	1,700	1,359	2	—	179	34	126	9·4
Wallingford	382	293	—	—	25	5	9	4·2
Wantage	481	440	—	—	24	9	8	3·5
Windsor	927	822	1	—	60	4	40	4·7
Wokingham	428	396	—	—	28	2	12	3·2
BUCKS.								
Amersham	577	515	2	—	31	10	19	5·0
Aylesbury	690	569	3	—	72	24	28	7·5
Buckingham	287	242	1	—	26	1	17	6·3
Eton	787	699	1	—	66	6	15	2·7
Newport Pagnell	759	657	2	—	68	8	24	4·2
Winslow	106	148	—	—	15	—	3	1·8
Wycombe	1,263	1,096	1	—	116	10	40	4·0
CAMBRIDGE.								
Cambridge	946	782	—	—	97	25	42	7·1
Caxton and Arrington	270	249	—	—	17	1	3	1·5
Chesterton	762	669	—	—	70	8	15	3·0
Ely	569	465	—	—	63	18	23	7·2
Linton	334	298	—	—	24	3	9	3·6
Newmarket	901	799	2	—	69	25	6	3·4
North Witchford	478	436	1	—	31	2	8	2·1
Whittlesey	152	138	—	—	12	—	2	1·3
Wisbech	803	734	—	—	91	7	61	7·6
CHESTER.								
Altrincham	1,703	1,516	6	—	133	20	28	2·8
Birkenhead	4,207	3,654	5	—	438	30	80	2·6
Chester	1,462	1,273	3	—	132	17	37	3·7
Congleton	1,134	987	—	—	108	16	23	3·4
Macclesfield	1,592	1,356	1	—	169	29	37	4·1
Nantwich	2,078	1,729	1	—	196	53	99	7·3
Northwich	1,788	1,594	1	—	172	5	16	1·2
Runcorn	1,426	1,248	—	—	144	9	35	3·1
Stockport	3,989	3,039	10	—	572	66	302	9·2
Tarvin	287	256	—	—	24	—	7	2·4
Wirral	1,052	865	1	—	108	7	51	5·6

	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent of births.
CORNWALL.								
Austell, St.	902	790	1	—	74	22	15	4·1
Bodmin	461	388	—	—	35	7	21	6·2
Camelford	195	156	—	—	24	12	3	7·7
Columb, St., Major	402	361	1	—	31	2	7	2·2
Falmouth	527	205	—	—	77	2	243	46·5
Germans, St.	481	422	—	—	50	4	5	1·0
Helston	593	461	—	—	94	22	16	6·4
Launceston	413	357	—	—	44	7	5	2·9
Liskeard	731	625	—	—	76	4	26	4·1
Penzance	1,299	1,015	—	—	159	11	114	9·6
Redruth	1,505	1,069	—	—	225	31	180	14·0
Stratton	174	152	—	—	16	3	3	3·4
Truro	803	568	1	—	83	17	134	18·8
CUMBERLAND.								
Alston-with-Garrigill	77	67	—	—	8	2	—	2·6
Bootle	527	404	1	—	44	24	54	14·8
Brampton	248	198	—	—	27	14	9	9·3
Carlisle	1,576	1,337	2	—	173	38	26	4·1
Cockermouth	2,568	1,981	—	—	318	78	191	10·5
Longtown	160	131	—	—	20	5	4	5·6
Penrith	550	491	—	—	48	6	5	2·0
Whitehaven	2,040	1,763	3	—	163	19	92	5·4
Wigton	694	612	—	—	50	19	13	4·6
DERBY.								
Ashbourne	562	477	—	—	53	4	28	5·7
Bakewell	793	669	2	—	70	13	39	6·6
Belper	1,966	1,743	1	—	185	13	24	1·9
Chapel-en-le-Frith	696	585	—	—	51	13	47	8·6
Chesterfield	3,792	2,853	1	—	355	82	501	15·4
Derby	2,597	1,803	4	—	289	28	383	15·8
Glossop	745	581	—	—	99	19	46	8·7
Hayfield	331	290	—	—	29	1	11	3,6
Shardlow	1,714	1,456	2	—	120	28	108	7·9
DEVON.								
Axminster	431	377	—	—	33	2	19	4·9
Barnstaple	1,141	974	2	—	105	26	34	5·3
Bideford	576	518	1	—	46	6	5	1·9
Crediton	477	425	—	—	37	2	13	3·1
East Stonehouse	524	457	1	—	47	5	14	3·6
Exeter	959	721	2	—	107	44	85	13·4
Holsworthy	246	221	—	—	19	4	2	2·4
Honiton	500	441	—	—	35	6	18	4·8
Kingsbridge	475	428	1	—	31	7	8	3·2
Newton Abbot	1,866	1,663	2	—	160	15	26	2·2
Okehampton	425	372	1	—	33	11	8	4·5
Plymouth	2,435	1,843	2	—	298	57	235	12·0
Plympton St. Mary	672	538	—	—	63	18	53	10·6
Southmolton	383	344	—	—	26	10	3	3·4
Stoke Damerel	1,570	1,195	—	—	152	54	169	14·2
Tavistock	751	655	—	—	71	2	23	3·3
Thomas, St.	1,286	1,090	3	—	89	61	43	8·1
Tiverton	724	634	3	—	54	9	24	4·6
Torrington	376	340	1	—	28	2	5	1·9
Totnes	1,077	971	—	—	78	4	24	2·6

PP. A. No. 1.

ort of Vaccination Officers' Returns, 1890.

	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
DORSET.								
Beaminster	259	233	—	—	13	5	8	5·0
Blandford	313	270	—	—	23	7	13	6·4
Bridport	368	317	2	—	32	5	12	4·6
Cerne	156	142	—	—	12	2	—	1·3
Dorchester	460	424	1	—	27	—	8	1·7
Poole	702	627	3	—	37	10	25	5·0
Shaftesbury	296	257	—	—	14	3	22	8·4
Sherborne	279	253	—	—	16	4	6	3·6
Sturminster	272	247	—	—	15	—	10	3·7
Wareham and Purbeck	468	427	—	—	32	1	8	1·9
Weymouth	764	496	—	—	52	2	214	28·3
Wimborne and Cranborne	453	387	—	—	30	13	23	7·9
DURHAM.								
Auckland	3,247	2,585	9	—	380	51	222	8·4
Chester-le-Street	1,866	1,502	4	—	218	35	107	7·6
Darlington	1,385	984	1	—	164	8	228	17·0
Durham	2,507	2,143	3	—	237	31	93	4·9
Easington	1,799	1,542	1	—	207	12	37	2·7
Gateshead	4,750	3,539	8	—	565	60	578	13·4
Hartlepool	2,495	1,981	4	—	304	27	179	8·3
Houghton-le-Spring	1,485	1,261	2	—	176	12	34	3·1
Lanchester	2,224	1,811	3	—	266	20	124	6·5
Sedgefield	692	600	1	—	61	8	22	4·3
South Shields	5,227	3,787	9	—	597	157	677	16·0
Stockton	2,254	1,634	2	—	256	80	282	16·1
Sunderland	6,012	5,046	11	—	655	63	237	5·0
Teesdale	559	447	—	—	56	9	47	10·0
Weardale	466	412	—	—	42	6	6	2·6
ESSEX.								
Billericay	469	391	—	—	42	19	17	7·7
Braintree	716	619	1	—	68	13	15	3·9
Chelmsford	914	798	—	—	71	15	40	6·0
Colchester	949	744	3	—	97	13	92	11·1
Dunmow	423	378	—	—	26	11	8	4·5
Epping	710	611	4	—	63	5	27	4·5
Halstead	447	386	1	—	35	4	21	5·6
Lexden and Winstree	588	534	1	—	42	3	8	1·9
Maldon	677	526	—	—	47	3	101	15·4
Ongar	267	222	—	—	17	7	21	10·5
Orsett	962	729	4	—	98	20	111	13·6
Rochford	894	731	1	—	74	40	48	9·8
Romford	1,657	1,244	4	—	148	58	203	16·0
Saffron Walden	445	410	3	—	17	1	14	3·4
Tendring	1,110	956	1	—	103	9	41	4·5
West Ham	12,043	9,220	45	—	1,099	348	1,331	13·9
GLOUCESTER.								
Barton Regis	5,529	4,605	15	—	540	88	281	6·7
Bristol	1,571	1,262	3	—	169	29	108	8·7
Cheltenham	1,264	841	2	—	150	73	198	21·4
Chipping Sodbury	421	366	2	—	26	6	21	6·4
Cirencester	553	449	2	—	49	10	43	9·6
Dursley	5,529	4,605	15	—	540	88	281	6·7
Gloucester	1,445	60	—	—	183	—	1,202	83·2
Newent	263	225	1	—	12	11	14	9·5
Northleach	224	192	—	—	16	3	13	7·1

	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
GLOUCESTER—*cont.*								
Stow-on-the-Wold	247	217	—	—	18	2	10	4·9
Stroud	1,147	943	—	—	108	21	75	8·4
Tetbury	154	113	—	—	13	9	19	18·1
Tewkesbury	323	249	1	—	22	5	45	15·5
Thornbury	459	421	—	—	27	1	10	2·4
Westbury-on-Severn	776	557	—	—	60	77	82	20·5
Wheatenhurst	187	117	—	—	14	22	34	29·9
Winchcomb	249	213	—	—	26	4	7	4·4
HEREFORD.								
Bromyard	277	233	—	—	21	6	17	8·3
Dore	211	167	1	—	25	5	13	8·5
Hereford	914	784	2	—	73	24	31	6·0
Kington	286	251	—	—	23	4	8	4·2
Ledbury	340	301	—	—	19	4	16	5·9
Leominster	334	297	—	—	24	9	4	3·9
Ross	452	369	—	—	43	7	13	4·6
Weobley	201	168	—	—	17	7	9	8·0
HERTS.								
Albans, St.	757	428	—	—	81	7	241	32·8
Barnet	1,240	839	—	—	119	8	274	22·7
Berkhampstead	466	416	—	—	42	3	5	1·7
Bishop's Stortford	538	460	—	—	34	7	17	4·5
Buntingford	138	126	—	—	9	—	6	4·3
Hatfield	182	155	—	—	14	2	11	7·1
Hemel Hempstead	415	356	1	—	27	8	23	7·5
Hertford	451	386	1	—	24	8	12	4·6
Hitchin	763	682	1	—	60	3	17	2·6
Royston	453	420	—	—	24	1	7	1·8
Ware	528	464	—	—	45	4	15	3·6
Watford	998	802	6	—	72	19	99	11·8
Welwyn	54	50	—	—	1	1	2	5·6
HUNTINGDON.								
Huntingdon	518	454	1	—	41	5	17	4·2
Ives, St.	397	352	2	—	30	4	9	3·3
Neots, St.	394	346	1	—	31	8	8	4·1
KENT (Extra-Metropolitan).								
Ashford, East	402	355	—	—	24	4	19	5·7
Ashford, West	488	398	2	—	42	13	33	9·4
Bean	531	456	—	—	46	3	26	5·5
Bridge	316	253	—	—	32	9	23	9·8
Bromley	1,533	1,414	3	—	232	84	100	10·0
Canterbury	447	380	—	—	45	4	18	4·9
Cranbrook	321	280	—	—	24	3	14	5·3
Dartford	2,056	1,511	10	—	186	36	263	17·0
Dover	1,041	748	2	—	116	22	146	16·8
Eastry	746	667	—	—	56	7	14	2·8
Elham	1,011	844	2	—	97	18	50	6·7
Faversham	828	737	3	—	68	4	16	2·4
Gravesend and Milton	636	469	2	—	56	2	97	1·6
Hollingbourn	327	285	2	—	28	2	10	3·7
Hoo	129	109	—	—	8	1	11	9·3
Maidstone	1,237	945	—	—	134	16	142	12·8

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	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
KENT (EXTRA-METROPOLITAN)—*cont.*								
Malling	841	720	—	—	86	7	28	4·2
Medway	2,244	1,721	4	—	221	88	210	13·3
Milton	881	752	—	—	81	21	27	5·4
Romney Marsh	178	171	—	—	6	—	1	0·6
Sevenoaks	766	661	1	—	66	15	23	5·0
Sheppey	544	483	1	—	48	5	7	2·2
Strood	1,191	1,021	4	—	119	6	41	3·9
Tenterden	250	214	—	—	24	3	9	4·8
Thanet, Isle of	1,397	1,224	4	—	114	20	35	3·9
Tonbridge	1,409	973	4	—	120	40	332	25·3
LANCASTER.								
Ashton-under-Lyne	4,905	3,618	14	—	638	49	586	12·9
Barrow-in-Furness	1,698	1,521	1	—	132	25	19	2·6
Barton-upon-Irwell	2,037	2,154	11	—	312	59	101	6·1
Blackburn	6,708	5,516	12	—	735	58	387	6·6
Bolton	7,177	6,395	11	—	644	11	116	1·8
Burnley	5,216	3,349	11	—	811	126	919	20·0
Bury	3,706	3,060	9	—	387	32	218	6·7
Chorley	1,717	1,442	2	—	168	3	103	6·1
Chorlton	9,108	7,147	8	—	1,177	187	589	8·5
Clitheroe	612	493	1	—	61	14	43	9·3
Fylde, The	1,485	1,187	6	—	173	50	69	8·0
Garstang	311	270	—	—	25	5	11	5·1
Haslingden	2,869	2,422	3	—	253	35	156	6·7
Lancaster	1,474	1,283	3	—	136	13	39	3·5
Leigh	2,550	2,156	2	—	237	14	141	6·1
Liverpool	5,100	4,168	11	—	695	11	215	4·4
Lunesdale	197	182	—	—	11	1	3	2·0
Manchester	5,108	4,190	3	—	664	74	177	4·9
Oldham	5,904	524	8	—	1,002	21	4,439	74·4
Ormskirk	2,558	2,171	5	—	235	37	110	5·7
Prescot	5,209	4,080	7	—	734	152	236	7·4
Preston	4,731	3,580	12	—	758	23	378	8·5
Prestwich	4,790	3,907	7	—	462	142	272	8·6
Rochdale	2,952	2,455	11	—	324	36	126	5·5
Salford	7,227	5,379	20	—	953	236	639	12·1
Todmorden	949	726	1	—	77	—	145	15·3
Toxteth Park	4,181	3,032	16	—	499	244	390	18·2
Ulverston	1,306	1,151	1	—	97	27	30	4·4
Warrington	3,074	2,597	5	—	315	13	144	5·1
West Derby	14,784	12,381	41	—	1,633	115	614	4·9
Wigan	6,304	5,322	19	—	717	125	211	5·3
LEICESTER.								
Ashby-de-la-Zouch	1,173	910	—	—	132	6	125	11·2
Barrow-on-Soar	1,036	185	—	—	155	9	687	67·2
Billesdon	367	174	3	—	42	18	130	46·3
Blaby	1,119	460	1	—	124	3	531	47·7
Hinckley	664	310	—	—	65	3	286	48·5
Leicester	4,697	118	—	—	882	—	3,697	78·7
Loughborough	945	244	—	—	121	4	376	61·4
Lutterworth	269	235	—	—	20	3	11	5·2
Market Bosworth	504	427	1	—	39	16	21	7·3
Market Harborough	412	344	—	—	41	5	22	6·6
Melton Mowbray	550	425	1	—	66	—	58	10·5

	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
LINCOLN.								
Boston	943	783	—	—	100	22	38	6·4
Bourn	527	425	2	—	40	23	37	11·4
Caistor	441	361	2	—	46	17	15	7·3
Gainsborough	1,000	852	—	—	108	3	37	4·0
Glanford Brigg	1,270	1,101	2	—	119	7	41	3·8
Grantham	912	787	3	—	84	10	28	4·2
Grimsby	2,075	1,634	7	—	293	75	66	6·8
Holbeach	490	414	1	—	53	7	15	4·5
Horncastle	473	413	—	—	29	5	26	6·6
Lincoln	1,795	1,421	4	—	232	50	88	7·7
Louth	804	666	—	—	76	21	41	7·7
Sleaford	633	523	—	—	58	9	43	8·2
Spalding	551	472	1	—	56	7	15	4·0
Spilsby	611	514	—	—	61	14	22	5·9
Stamford	412	354	—	—	41	6	11	4·1
MIDDLESEX (Extra-Metropolitan).								
Brentford	3,741	3,022	14	—	357	18	330	9·3
Edmonton	7,088	5,547	23	—	606	104	808	12·9
Hendon	2,800	2,176	22	—	242	18	342	12·9
Staines	751	554	—	—	63	24	110	17·8
Uxbridge	857	739	—	—	78	4	36	4·7
MONMOUTH.								
Abergavenny	731	608	3	—	82	27	11	5·2
Bedwellty	2,441	2,011	—	—	273	64	93	6·4
Chepstow	553	477	—	—	53	6	17	4·2
Monmouth	771	668	—	—	63	12	28	5·2
Newport	3,373	2,845	1	—	330	55	142	5·8
Pontypool	1,376	1,085	1	—	137	36	117	11·1
NORFOLK.								
Aylsham	462	407	—	—	38	7	10	3·7
Blofield	323	278	—	—	34	6	5	3·4
Depwade	596	505	—	—	49	12	30	7·0
Docking	438	384	—	—	39	9	6	3·4
Downham	497	441	—	—	41	7	8	3·0
Erpingham	529	454	1	—	44	9	21	5·7
Faith, St.	359	265	—	—	47	15	32	13·1
Fleggs, East and West	287	232	—	—	48	1	6	2·4
Forehoe	292	238	1	—	28	4	21	8·6
Freebridge Lynn	332	277	—	—	30	14	11	7·5
Guilteross	271	240	—	—	24	1	6	2·6
Henstead	326	273	2	—	25	—	26	8·0
King's Lynn	542	245	—	—	79	—	218	40·2
Loddon and Clavering	358	301	—	—	36	1	20	5·9
Mitford and Launditch	685	581	1	—	76	6	21	3·9
Norwich	3,133	2,133	1	—	409	17	573	18·8
Smallburgh	478	394	1	—	45	8	30	7·9
Swaffham	317	246	—	—	24	3	44	14·8
Thetford	444	398	—	—	39	—	7	1·6
Walsingham	546	451	2	—	50	4	39	7·9
Wayland	292	248	1	—	30	7	6	4·5
Yarmouth, Great	1,525	1,176	6	—	177	33	133	10·9

APP. A. No. 1.

Digest of Vaccination Officers' Returns, 1890.

	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
NORTHAMPTON.								
Brackley	315	239	—	—	29	4	43	14·9
Brixworth	286	229	—	—	22	—	35	12·2
Daventry	429	377	—	—	26	7	19	6·1
Hardingstone	312	248	—	—	38	6	20	8·3
Kettering	1,149	308	1	—	223	9	603	53·3
Northampton	2,469	277	1	—	346	31	1,812	74·6
Oundle	316	286	—	—	17	6	7	4·1
Peterborough	1,306	1,119	—	—	109	12	66	6·6
Potterspury	329	267	—	—	26	14	22	10·9
Thrapston	368	152	—	—	28	—	188	51·1
Towcester	324	252	—	—	39	25	8	10·2
Wellingborough	1,330	216	—	—	155	4	955	72·1
NORTHUMBERLAND.								
Alnwick	615	528	—	—	57	8	22	4·9
Belford	155	148	—	—	6	1	—	0·6
Bellingham	103	88	—	—	10	1	3	3·9
Berwick-upon-Tweed	550	469	—	—	58	17	6	4·2
Castle Ward	697	580	1	—	65	7	44	7·8
Glendale	234	213	—	—	15	4	2	2·6
Haltwhistle	212	178	—	—	22	3	9	5·7
Hexham	903	763	—	—	75	13	52	7·5
Morpeth	1,372	1,065	2	—	246	13	44	4·2
Newcastle-on-Tyne	6,935	5,520	10	—	782	235	388	9·0
Rothbury	132	123	—	—	8	—	1	0·8
Tynemouth	4,621	3,544	6	—	553	225	293	11·2
NOTTINGHAM.								
Basford	5,533	4,393	8	—	613	93	486	9·4
Bingham	369	308	—	—	26	13	22	9·5
East Retford	684	622	1	—	43	4	14	2·6
Mansfield	1,907	1,536	1	—	184	14	182	10·3
Newark	816	726	1	—	61	9	19	3·4
Nottingham	4,912	3,417	10	—	608	59	818	17·9
Southwell	482	407	—	—	47	6	22	5·8
Worksop	1,036	906	4	—	96	7	23	2·9
OXFORD.								
Banbury	777	358	—	—	84	18	317	43·1
Bicester	412	354	—	—	34	2	23	5·8
Chipping Norton	523	445	—	—	34	19	25	8·4
Headington	950	839	3	—	87	7	14	2·2
Henley	611	500	—	—	61	10	40	8·2
Oxford	594	506	4	—	54	7	23	5·1
Thame	359	310	1	—	29	4	15	5·3
Witney	583	517	—	—	56	5	4	1·5
Woodstock	374	316	1	—	34	5	18	6·1
RUTLAND.								
Oakham	262	227	—	—	26	6	3	3·4
Uppingham	258	230	—	—	13	—	15	5·9

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Digest of Vaccination Officers' Returns, 1890.

	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
SALOP.								
Atcham	1,265	1,093	—	—	104	22	46	5·4
Bridgnorth	384	322	—	—	35	2	25	7·0
Church Stretton	134	126	—	—	6	2	—	1·5
Cleobury Mortimer	229	202	1	—	20	2	4	2·6
Clun	266	222	—	—	24	4	16	7·5
Drayton	373	335	1	—	30	1	6	1·9
Ellesmere	343	299	—	—	35	4	5	2·6
Ludlow	450	374	1	—	49	9	17	5·8
Madeley	651	589	—	—	48	—	14	2·2
Newport	399	351	—	—	28	4	16	5·0
Oswestry	774	707	1	—	46	9	11	2·6
Shifnal	334	283	2	—	26	9	14	6·9
Wellington	687	604	1	—	61	8	13	3·1
Wem	259	236	—	—	21	—	2	0·8
Whitchurch	308	267	—	—	31	3	7	3·2
SOMERSET.								
Axbridge	1,014	655	2	—	74	8	275	27·9
Bath	1,782	1,136	3	—	171	95	377	26·5
Bedminster	2,511	1,715	11	—	333	30	422	18·0
Bridgwater	927	745	1	—	76	22	83	11·3
Chard	709	607	—	—	63	19	20	5·5
Clutton	811	706	—	—	66	10	29	4·8
Dulverton	126	114	—	—	10	1	1	1·6
Frome	626	550	—	—	42	4	30	5·4
Keynsham	950	688	4	—	88	—	170	17·9
Langport	424	367	1	—	31	6	19	5·9
Shepton Mallet	458	390	—	—	43	2	23	5·5
Taunton	1,031	573	—	—	82	17	59	7·4
Wellington	463	363	—	—	47	17	36	11·4
Wells	589	504	4	—	50	8	23	5·3
Williton	432	383	1	—	38	6	4	2·3
Wincanton	472	404	—	—	36	9	23	6·8
Yeovil	784	661	3	—	62	29	29	7·4
SOUTHAMPTON.								
Alresford	184	165	—	—	12	3	4	3·8
Alton	379	351	—	—	17	2	9	2·9
Alverstoke	794	726	1	—	57	1	9	1·3
Andover	451	385	—	—	32	8	26	7·5
Basingstoke	538	344	—	—	37	3	154	29·2
Catherington	76	68	—	—	8	2	1	3·9
Christchurch	1,270	842	6	—	120	13	289	23·8
Droxford	290	262	—	—	18	5	5	3·4
Fareham	529	472	1	—	43	—	13	2·5
Fordingbridge	174	160	—	—	10	—	4	2·3
Hartley Wintney	631	527	1	—	52	12	39	8·1
Havant	253	225	—	—	15	4	11	5·9
Hursley	75	65	2	—	7	—	1	1·4
Kingsclere	234	215	—	—	13	4	2	2·6
Lymington	367	314	—	—	21	4	28	8·7
New Forest	361	313	—	—	23	2	23	6·9
Petersfield	321	280	—	—	21	8	12	6·2
Portsea Island	4,797	4,220	—	—	444	27	106	2·8
Ringwood	139	128	—	—	9	—	2	1·4
Romsey	281	253	—	—	18	4	6	3·6
Southampton	1,590	1,267	3	—	152	38	130	10·6
South Stoneham	1,335	1,125	2	—	82	20	106	9·4
Stockbridge	167	142	—	—	17	3	5	4·8
Whitchurch	171	141	—	—	20	8	2	5·8
Wight, Isle of	1,842	1,601	—	—	124	54	63	6·4
Winchester, New	731	651	1	—	38	17	24	5·6

APP. A. No. 1.

Digest of Vaccination Officers' Returns, 1890.

	RETURNS, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
STAFFORD.								
Burton-upon-Trent	2,658	2,090	1	—	282	40	245	10·7
Cannock	1,424	1,222	—	—	123	2	77	5·5
Cheadle	693	596	—	—	60	7	30	5·2
Leek	1,009	846	1	—	108	24	30	5·4
Lichfield	1,171	1,025	8	—	112	10	16	2·2
Newcastle-under-Lyme	1,325	1,170	2	—	124	6	23	2·2
Seisdon	445	400	—	—	28	3	14	3·6
Stafford	818	691	1	—	75	19	33	6·2
Stoke-upon-Trent	4,342	3,370	2	—	602	79	289	8·5
Stone	948	803	1	—	93	19	32	5·4
Tamworth	708	591	—	—	68	9	40	6·9
Uttoxeter	395	339	—	—	43	1	12	3·3
Walsall	3,648	2,655	8	—	492	47	446	13·5
West Bromwich	4,873	4,184	13	—	527	60	89	3·1
Wolstanton and Burslem	3,096	2,561	2	—	411	10	112	3·9
Wolverhampton	4,798	3,729	15	—	570	47	437	10·1
SUFFOLK.								
Blything	704	612	—	—	48	4	40	6·2
Bosmere and Claydon	424	369	—	—	29	6	20	6·1
Bury St. Edmunds	417	357	1	—	33	12	14	6·2
Cosford	470	422	—	—	30	8	10	3·8
Hartismere	420	373	—	—	32	2	13	3·6
Hoxne	320	278	1	—	26	2	13	4·7
Ipswich	1,706	1,118	—	—	153	74	361	25·5
Mildenhall	234	207	—	—	18	4	5	3·8
Mutford and Lothingland	1,110	960	—	—	94	25	11	3·2
Plomesgate	508	449	—	—	36	2	21	4·5
Risbridge	494	430	—	—	54	3	7	2·6
Samford	364	335	—	—	18	4	7	3·6
Stow	525	465	1	—	45	4	10	2·7
Sudbury	820	723	—	—	61	12	24	4·4
Thingoe	403	349	—	—	31	10	13	5·7
Wangford	441	392	2	—	34	4	9	2·9
Woodbridge	619	530	—	—	59	13	17	4·8
SURREY (EXTRA-METROPOLITAN).								
Chertsey	823	661	1	—	61	34	65	13·0
Croydon	3,889	2,978	5	—	337	71	496	14·8
Dorking	401	350	1	—	22	5	23	7·0
Epsom	1,106	851	3	—	85	19	148	15·1
Farnham	1,421	1,225	3	—	104	10	79	6·8
Godstone	446	400	—	—	22	3	21	5·4
Guildford	1,331	1,154	1	—	81	29	66	7·1
Hambledon	549	497	—	—	37	3	12	2·7
Kingston	2,662	1,572	3	—	189	16	882	33·7
Reigate	842	725	5	—	59	27	26	6·3
Richmond	1,053	933	4	—	83	2	33	6·3
SUSSEX.								
Battle	483	383	—	—	38	19	43	12·6
Brighton	2,541	2,078	11	—	256	51	145	7·7
Chailey	249	199	—	—	22	5	23	11·2
Chichester	193	163	—	—	17	1	6	3·6
Cuckfield	590	515	1	—	38	19	22	6·1
Eastbourne	940	223	—	—	105	12	600	65·1
East Grinstead	536	424	2	—	45	20	45	19·1
East Preston	730	632	—	—	56	15	25	6·5

	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
SUSSEX—*cont.*								
Hailsham	374	296	4	—	28	7	37	11·8
Hastings	1,370	1,122	3	—	99	41	106	10·7
Horsham	649	549	—	—	60	9	31	6·2
Lewes	272	177	—	—	19	1	75	27·6
Midhurst	347	306	—	—	28	7	6	3·7
Newhaven	269	230	—	—	17	—	22	8·2
Petworth	233	199	—	—	14	4	6	4·5
Rye	316	286	1	—	20	1	8	2·8
Steyning	1,367	1,177	3	—	99	37	52	6·5
Thakeham	210	194	—	—	13	2	1	1·4
Ticehurst	429	355	2	—	29	2	41	10·0
Uckfield	575	432	—	—	31	3	109	19·5
Westbourne	207	182	—	—	10	4	11	7·2
West Firle	66	53	—	—	2	3	9	18·2
Westhampnett	533	469	—	—	41	8	15	4·3
WARWICK.								
Alcester	581	501	—	—	55	8	17	4·3
Aston	8,395	6,564	23	—	964	154	691	10·1
Atherstone	530	455	—	—	46	3	26	5·5
Birmingham	7,964	6,496	22	—	984	25	435	5·8
Coventry	1,544	1,221	3	—	184	—	139	9·0
Polesbill	584	459	—	—	72	—	23	3·9
Meriden	240	199	—	—	22	1	18	7·9
Nuneaton	568	438	—	—	79	3	48	9·0
Rugby	719	632	—	—	61	4	20	3·3
Solihull	748	606	—	—	66	28	48	10·2
Southam	305	259	1	—	26	2	17	6·2
Stratford-on-Avon	553	475	—	—	45	4	29	6·0
Warwick	1,341	1,135	—	—	134	23	49	5·4
WESTMORLAND.								
East Ward	330	342	—	—	30	4	4	2·1
Kendal	1,141	1,026	2	—	88	13	12	2·2
West Ward	198	180	—	—	8	1	9	5·1
WILTS.								
Alderbury	742	651	1	—	45	6	39	6·1
Amesbury	161	141	—	—	17	—	3	1·9
Bradford	301	271	—	—	23	—	7	2·3
Calne	220	191	1	—	17	6	5	5·0
Chippenham	588	529	—	—	33	7	19	4·4
Cricklade and Wootton Bassett.	354	301	—	—	30	8	15	6·5
Devizes	500	432	—	—	33	10	25	7·0
Highworth and Swindon	1,555	1,169	2	—	134	32	218	16·1
Malmesbury	331	259	—	—	30	25	17	12·7
Marlborough	236	210	—	—	16	—	—	0·0
Melksham	478	446	—	—	25	5	2	1·5
Mere	157	145	—	—	9	—	3	1·9
Pewsey	333	286	—	—	39	1	7	2·5
Tisbury	223	190	—	—	12	10	11	9·4
Warminster	334	288	—	—	16	3	27	9·0
Westbury and Whorwellsdown.	250	221	—	—	21	4	4	3·2
Wilton	258	231	—	—	19	1	7	3·1

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	Returns 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
WORCESTER.								
Bromsgrove	1,012	834	5	1	107	18	47	6·4
Droitwich	507	450	—	—	40	5	12	3·4
Dudley	5,539	4,737	15	—	642	26	119	2·6
Evesham	429	382	—	—	27	2	18	4·7
Kidderminster	1,128	990	1	—	117	2	18	1·8
King's Norton	3,344	2,826	7	—	327	47	137	5·5
Martley	409	352	1	—	45	—	11	2·7
Pershore	384	347	—	—	24	2	11	3·4
Shipston-on-Stour	431	374	1	—	35	5	16	4·9
Stourbridge	2,951	2,596	11	—	295	17	32	1·7
Tenbury	183	160	—	—	15	1	7	4·4
Upton-on-Severn	520	443	—	—	49	6	22	5·4
Worcester	1,255	906	3	—	172	29	145	13·9
YORK, East Riding.								
Beverley	678	574	—	—	61	13	30	6·3
Bridlington	441	363	—	—	40	4	34	8·6
Driffield	486	422	—	—	38	1	25	5·3
Howden	390	335	—	—	37	—	18	4·6
Kingston-upon-Hull	2,382	1,803	13	—	314	27	225	10·6
Patrington	217	160	—	—	13	—	44	20·3
Pocklington	378	322	2	—	35	6	13	5·0
Sculcoates	4,597	3,822	20	—	485	27	233	5·7
Skirlaugh	256	223	—	—	25	2	8	3·9
York	2,304	1,942	2	—	230	20	110	5·6
YORK, North Riding.								
Ayesgarth	131	111	1	—	16	1	2	2·3
Bedale	227	206	—	—	17	—	4	1·8
Easingwold	228	196	—	—	19	1	12	5·7
Guisborough	1,249	1,044	—	—	143	20	42	5·0
Helmsley	136	107	2	—	12	12	3	11·0
Kirkby Moorside	114	91	—	—	12	7	4	9·6
Leyburn	167	158	—	—	8	1	—	0·6
Malton	607	484	2	—	61	16	44	9·9
Middlesbrough	4,466	3,720	—	—	564	101	81	4·1
Northallerton	280	233	1	—	20	1	5	2·3
Pickering	332	266	—	—	39	8	19	8·1
Reeth	92	82	—	—	8	1	1	2·2
Richmond	339	274	—	—	38	9	18	8·0
Scarborough	1,225	725	—	—	150	26	324	28·6
Stokesley	295	265	—	—	24	5	1	2·0
Thirsk	303	267	—	—	24	2	10	4·0
Whitby	775	654	1	—	74	19	27	5·9
YORK, West Riding.								
Barnsley	3,684	2,824	6	—	442	17	395	11·2
Bierley, North	3,743	2,713	8	—	429	43	550	15·8
Bradford	5,813	3,539	10	—	849	28	1,387	24·3
Bramley	2,200	1,742	4	—	266	37	151	8·5
Dewsbury	4,619	2,090	5	—	718	66	1,740	39·1
Doncaster	1,897	1,525	11	—	224	73	64	7·2
Ecclesall Bierlow	3,981	3,246	26	—	505	33	172	5·1
Goole	858	717	2	—	101	7	31	4·4
Halifax	4,900	737	4	—	747	42	3,370	69·6

	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
YORK, West Riding—*cont.*								
Hemsworth	516	432	—	—	54	2	28	5·8
Holbeck	861	717	1	—	102	17	24	4·8
Huddersfield	4,030	3,552	15	—	398	14	51	1·6
Hunslet	2,530	2,094	8	—	328	23	77	4·0
Keighley	1,927	97	—	—	287	—	1,543	80·1
Knaresborough	653	492	—	—	78	40	34	12·7
Leeds	7,185	6,084	21	—	712	40	328	5·1
Ouseburn, Great	352	317	1	—	20	5	9	4·0
Pateley Bridge	194	169	4	—	17	—	4	2·1
Penistone	554	485	—	—	56	3	10	2·3
Pontefract	2,149	1,756	4	—	282	12	95	5·0
Ripon	422	328	—	—	33	6	55	14·5
Rotherham	3,312	2,831	6	—	338	18	119	4·1
Saddleworth	505	295	—	—	69	—	231	38·8
Sedbergh	83	74	—	—	9	—	—	0·0
Selby	437	400	—	—	31	2	4	1·4
Settle	371	308	1	—	40	5	17	5·9
Sheffield	7,265	5,914	16	—	917	23	395	5·8
Skipton	1,065	710	5	—	108	55	187	22·7
Tadcaster	855	715	—	—	101	4	35	4·6
Thorne	419	341	—	—	39	11	28	9·3
Wakefield	3,169	2,675	2	—	346	33	113	4·6
Wetherby	336	285	—	—	30	9	12	6·2
Wharfedale	1,368	1,047	6	—	124	23	168	14·0
Wortley	1,272	1,051	2	—	130	12	77	7·0
ANGLESEY.								
Anglesey	329	294	—	—	26	2	7	2·8
Holyhead	472	398	—	—	54	4	16	4·2
BRECKNOCK.								
Brecknock	389	342	—	—	43	1	3	1·0
Builth	234	200	—	—	22	3	9	5·1
Crickhowell	636	527	—	—	53	7	49	8·8
Hay	277	238	—	—	27	9	3	4·3
CARDIGAN.								
Aberayron	291	250	—	—	27	—	14	4·8
Aberystwith	483	426	—	—	37	11	9	4·1
Cardigan	385	328	—	—	38	7	12	4·9
Lampeter	234	204	—	—	22	4	4	3·4
Tregaron	190	167	—	—	16	2	5	3·7
CARMARTHEN.								
Carmarthen	934	860	—	—	64	3	7	1·1
Llandilofawr	553	489	—	—	53	3	8	2·0
Llandovery	295	263	—	—	24	5	3	2·7
Llanelly	1,769	1,557	—	—	178	13	21	1·9
Newcastle-in-Emlyn	494	433	—	—	49	—	12	2·4

APP. A. No. 1.

Digest of Vaccination Officers' Returns, 1890.

	Returns, 1890.							
	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed.	Remaining.	Children not finally accounted for (including cases postponed), per cent. of births.
CARNARVON.								
Bangor and Beaumaris	907	789	2	—	79	15	22	4·1
Carnarvon	1,026	849	—	—	119	24	34	5·7
Conway	585	530	—	—	40	7	8	2·6
Pwllheli	523	451	—	—	44	21	7	5·4
DENBIGH.								
Llanrwst	315	281	—	—	25	5	4	2·9
Ruthin	309	269	—	—	37	2	1	1·0
Wrexham	1,990	1,629	1	—	203	60	87	7·4
FLINT.								
Asaph, St.	656	573	—	—	60	6	17	3·5
Hawarden	454	399	—	—	30	8	17	5·5
Holywell	1,122	958	—	—	101	26	37	5·6
GLAMORGAN.								
Bridgend and Cowbridge	1,653	1,416	1	—	189	27	20	2·8
Cardiff	5,989	4,885	11	—	656	33	384	7·0
Gower	337	278	—	—	40	16	3	5·6
Merthyr Tydfil	4,125	3,527	2	—	430	126	40	4·0
Neath	1,916	1,682	2	—	173	39	20	3·1
Pontardawe	758	666	—	—	69	14	9	3·0
Pontypridd	5,594	4,621	1	—	723	75	174	4·5
Swansea	3,897	3,410	5	—	367	40	75	3·0
MERIONETH.								
Bala	146	120	—	—	16	5	5	6·8
Corwen	425	365	1	—	42	11	6	4·0
Dolgelley	349	303	1	—	35	6	4	2·9
Festiniog	863	696	—	—	78	17	12	3·6
MONTGOMERY.								
Forden	426	377	—	—	35	9	5	3·3
Llanfyllin	479	400	1	—	58	9	11	4·2
Machynlleth	227	206	—	—	18	2	1	1·3
Newtown and Llanidloes	502	490	—	—	48	4	20	4·3
PEMBROKE.								
Haverfordwest	956	780	1	—	98	13	64	8·1
Narberth	461	398	—	—	43	15	5	4·3
Pembroke	887	752	—	—	85	19	31	5·6
RADNOR.								
Knighton	301	238	—	—	22	12	31	14·2
Rhayader	148	126	—	—	13	—	9	6·1

No. 2.

LIST (alphabetically arranged) of 243 UNIONS inspected during the Year 1892, with reference to the PROCEEDINGS under the VACCINATION ACTS, 1867 and 1871, and an ACCOUNT of the AWARDS certified by the BOARD as payable to the respective PUBLIC VACCINATORS out of COUNTY FUNDS.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Aberayron	2	2	10 1 0	11 13 0	21 14 0	Dr. Fletcher.
Abergavenny	3	3	4 3 0	21 1 0	40 11 0	Do.
Aberystwith	4	3	7 16 0	17 4 0	37 17 0	Do.
Alston-with-Garrigill	2	2	2 13 0	4 0 0	6 13 0	Mr. T. W. Thompson.
Alton	4	2	5 12 0	9 1 0	14 13 0	Mr. Sweeting.
Altrincham	6	4	4 1 0	35 8 0	58 7 0	Dr. Fletcher.
Amersham	6	3	4 11 0	18 15 0	29 9 0	„ BruceLow.
Ashby-de-la-Zouch	5	5	7 6 0	22 17 0	61 8 0	„ Parsons.
Ashton-under-Lyne	12	4	1 11 0	23 3 0	47 9 0	Mr. T. W. Thompson.
Axbridge	11	10	2 8 0	10 18 0	56 7 0	Mr. Sweeting.
Axminster	12	4	1 1 0	5 2 0	12 1 0	Dr. BruceLow.
Aylesbury	7	4	2 19 0	5 18 0	18 12 0	Do.
Aylsham	7	4	5 5 0	9 1 0	26 17 0	„ Airy.
Barnsley	5	4	18 17 0	80 12 0	187 16 0	Dr. Theo. Thomson.
Barrow-on-Soar	6	1	—	—	0 17 0	Dr. Bulstrode.
Basford	13	10	4 3 0	71 13 0	278 1 0	„ BruceLow.
Basingstoke	7	5	0 17 0	7 12 0	20 16 0	Mr. Sweeting.
Bath	5	4	9 14 0	27 13 0	70 17 0	Do.
Battle	6	4	1 8 0	9 1 0	19 9 0	Do.
Bedminster	9	5	3 8 0	35 0 0	54 19 0	Do.
Bedwellty	6	6	3 16 0	43 19 0	140 11 0	Dr. Fletcher.
Bethnal Green	2	1	—	—	36 14 0	„ Airy.
Billericay	4	4	3 2 0	19 12 0	39 6 0	„ Copeman.
Billesdon	3	1	—	—	5 8 0	„ Bulstrode.
Bingham	4	3	4 11 0	5 2 0	14 8 0	„ BruceLow.
Birkenhead	3	1	—	—	129 11 0	„ Fletcher.

App. A. No. 2.

Inspection of Public Vaccination.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum. £ s. d.	Range of Awards in each Union. Maximum. £ s. d.	Total Sum awarded in each Union. £ s. d.	Medical Inspector.
Birmingham - -	1	1	—	—	79 2 0	Dr. Airy.
Blaby - - -	3	—	—	—	—	„ Bulstrode.
Blofield - - -	3	3	3 3 0	14 13 0	28 1 0	„ Airy.
Boston - - -	8	6	1 15 0	13 19 0	35 7 0	„ BruceLow.
Bourn - - -	7	2	4 0 0	6 5 0	10 5 0	Do.
Braintree - - -	7	6	6 16 0	19 5 0	76 1 0	„ Copeman.
Brampton - - -	1	—	—	—	—	Mr. T. W. Thompson.
Brecknock - -	3	3	7 1 0	15 17 0	32 4 0	Dr. Fletcher.
Brentford - - -	9	7	6 16 0	27 6 0	130 0 0	„ BruceLow.
Bridgend and Cowbridge	7	4	13 1 0	19 6 0	63 7 0	„ Fletcher.
Bridgwater - -	10	6	4 2 0	13 19 0	40 11 0	Mr. Sweeting.
Bridport - - -	3	3	3 13 0	25 15 0	31 10 0	Dr. Fletcher.
Brighton - - -	2	1	—	—	38 15 0	Mr. Sweeting.
Bromley - - -	6	3	2 7 0	23 18 0	35 15 0	Do.
Buckingham - -	3	3	4 5 0	8 3 0	17 4 0	Dr. BruceLow.
Builth - - -	1	—	—	—	—	„ Fletcher.
Caistor - - -	8	5	1 7 0	4 12 0	15 2 0	Dr. BruceLow.
Camberwell - -	5	3	52 10 0	76 17 0	191 18 0	„ Airy.
Cardiff - - -	8	6	2 2 0	121 4 0	350 3 0	„ Fletcher.
Cardigan - - -	3	3	11 14 0	16 11 0	40 17 0	Do.
Carmarthen - -	6	6	10 10 0	29 2 0	92 19 0	Do.
Chailey - - -	4	3	1 2 0	8 7 0	16 13 0	Mr. Sweeting.
Chard - - -	7	6	4 8 0	25 18 0	80 7 0	Do.
Cheadle - - -	5	5	6 5 0	14 1 0	41 2 0	Dr. Parsons.
Chelmsford - -	9	8	5 0 0	12 12 0	66 13 0	„ Copeman.
Chepstow - - -	5	4	2 11 0	10 0 0	26 11 0	„ Fletcher.
Chester - - -	3	—	—	—	—	Mr. T. W. Thompson.
Chichester - -	1	1	—	—	13 9 0	Mr. Sweeting.
Chorlton - - -	13	8	3 5 0	48 1 0	192 16 0	„ T. W. Thompson.
Clutton - - -	5	2	8 17 0	35 11 0	44 8 0	Mr. Sweeting.
Cockermouth - -	5	3	6 12 0	62 14 0	84 14 0	„ T. W. Thompson.
Colchester - - -	1	—	—	—	—	Dr. Copeman.
Congleton - - -	4	3	7 3 0	35 9 0	75 5 0	„ Fletcher.
Coventry - - -	1	1	—	—	51 2 0	„ Airy.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Crickhowell - -	2	2	9 16 0	57 10 0	67 6 0	Dr. Fletcher.
Cuckfield - - -	6	4	2 11 0	11 14 0	29 8 0	Mr. Sweeting.
Dartford - - -	5	3	9 7 0	47 8 0	82 18 0	Mr. Sweeting.
Depwade - - -	8	6	2 14 0	11 11 0	47 10 0	Dr. Airy.
Docking - - -	4	2	5 0 0	15 12 0	20 12 0	Do.
Downham - - -	7	3	2 6 0	10 0 0	19 11 0	Do.
Dulverton - - -	3	3	1 4 0	12 3 0	15 3 0	Mr. Sweeting.
Dunmow - - -	6	4	3 10 0	11 4 0	28 17 0	Dr. Copeman.
Easingwold - -	4	2	4 17 0	7 8 0	12 5 0	Dr. BruceLow.
Eastbourne - -	4	2	4 4 0	9 1 0	13 5 0	Mr. Sweeting.
East Grinstead - -	6	6	3 3 0	13 7 0	47 13 0	Do.
East Preston - -	3	1	—	—	34 13 0	Do.
East Retford - -	6	2	1 15 0	6 14 0	8 9 0	Dr. BruceLow.
East Ward - -	6	5	1 12 0	7 8 0	26 0 0	Mr. T. W. Thompson.
Ecclesall Bierlow -	3	3	11 8 0	91 5 0	190 1 0	Dr. Theo. Thomson.
Edmonton - -	13	10	0 9 0	35 13 0	121 13 0	„ BruceLow.
Epping - - -	7	4	6 0 0	17 4 0	39 16 0	„ Copeman.
Erpingham - -	3	2	17 0 0	17 4 0	34 4 0	„ Airy.
Eton - - -	8	7	2 16 0	14 4 0	49 6 0	„ BruceLow.
Faith, St. - - -	5	3	5 15 0	7 7 0	18 18 0	Dr. Airy.
Flegg, East and West -	4	—	—	—	—	Do.
Forehoe - - -	6	4	2 16 0	14 10 0	26 4 0	Do.
Freebridge Lynn - -	4	4	4 8 0	10 7 0	28 0 0	Do.
Frome - - -	5	3	2 17 0	6 8 0	16 13 0	Mr. Sweeting.
Fulham - - -	3	3	73 4 0	88 9 0	243 1 0	Dr. Airy.
Gainsborough - -	3	6	2 1 0	8 3 0	28 0 0	Dr. BruceLow.
George, St., Hanover Square.	4	3	2 16 0	35 0 0	43 17 0	Mr. Sweeting.

APP. A. No. 2.

Inspection of Public Vaccination.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Giles, St., and St. George, Bloomsbury.	1	1	—	—	21 2 0	Dr. Airy.
Glanford Brigg	9	7	5 17 0	15 17 0	65 13 0	„ BruceLow.
Gower	3	1	—	—	10 3 0	„ Fletcher.
Grantham	7	3	4 15 0	6 19 0	16 13 0	„ BruceLow.
Gravesend and Milton	1	1	—	—	22 0 0	Mr. Sweeting.
Greenwich	2	1	—	—	30 16 0	Dr. Airy.
Grimsby	3	—	—	—	—	„ BruceLow.
Guilteross	5	4	4 0 0	8 17 0	25 10 0	„ Airy.
Hackney	4	4	22 17 0	46 3 0	137 10 0	Dr. Airy.
Hailsham	7	3	3 7 0	6 3 0	14 18 0	Mr. Sweeting.
Halifax	9	8	1 2 0	6 8 0	33 5 0	Dr. Theo. Thomson.
Halstead	5	3	4 0 0	9 10 0	21 18 0	„ Copeman.
Hampstead	1	1	—	—	15 5 0	Mr. Sweeting.
Hartley Wintney	6	5	1 19 0	12 1 0	38 12 0	Do.
Hastings	2	1	—	—	1 14 0	Do.
Haverfordwest	4	1	—	—	20 17 0	„ Fletcher.
Hay	3	3	5 16 0	7 4 0	19 10 0	Do.
Hendon	6	5	3 9 0	63 10 0	109 6 0	„ BruceLow.
Henstead	4	2	3 3 0	6 14 0	9 17 0	„ Airy.
Hinckley	5	4	1 6 0	5 11 0	13 15 0	„ Bulstrode.
Holbeach	6	5	1 11 0	6 16 0	24 7 0	„ BruceLow.
Holborn	4	2	25 13 0	31 15 0	57 7 0	„ Airy.
Honiton	12	4	1 8 0	11 15 0	33 0 0	„ BruceLow.
Horncastle	6	2	3 5 0	5 4 0	8 9 0	Do.
Horsham	8	6	2 7 0	6 17 0	25 15 0	Mr. Sweeting.
Hursley	1	1	—	—	2 17 0	Do.
Islington*	5	5	14 0 0	33 9 0	120 14 0	Dr. Airy.

* Inspected in 1891.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Kendal	9	7	3 5 0	12 4 0	57 11 0	Mr. T. W. Thompson.
Kensington	2	—	—	—	—	Mr. Sweeting.
Keynsham	1	1	—	—	82 4 0	Do.
Kingsclere	3	1	—	—	6 10 0	Do.
King's Lynn	1	1	—	—	18 0 0	Dr. Airy.
Kingston-on-Hull	2	2	18 14 0	48 9 0	67 3 0	„ Barry.
Knighton	5	2	1 7 0	6 8 0	7 15 0	„ Fletcher.
Lambeth	5	5	11 14 0	93 15 0	306 5 0	Dr. Airy.
Lampeter	2	2	7 11 0	14 18 0	22 9 0	„ Fletcher.
Langport	6	5	2 7 0	8 16 0	34 6 0	Mr. Sweeting.
Leeds	7	6	1 11 0	72 8 0	155 14 0	Dr. Airy.
Leek	5	4	1 12 0	9 17 0	21 9 0	„ Parsons.
Leicester	2	—	—	—	—	„ Bulstrode.
Lewes	1	1	—	—	15 3 0	Mr. Sweeting.
Lexden and Winstree	10	8	4 5 0	16 6 0	64 16 0	Dr. Copeman.
Lincoln	11	9	1 18 0	23 9 0	61 15 0	„ Bruce Low.
Liverpool	3	1	—	—	67 4 0	„ Airy.
Llandilofawr	5	5	5 5 0	20 1 0	60 19 0	„ Fletcher.
Llandovery	2	1	—	—	18 1 0	Do.
Llanelly	3	3	26 7 0	127 5 0	185 5 0	Do.
Loddon and Clavering	4	3	3 5 0	9 15 0	22 4 0	„ Airy.
Loughborough	4	3	2 4 0	6 5 0	10 19 0	„ Bulstrode.
Lowestoft	11	11	1 11 0	13 6 0	57 18 0	„ Bruce Low.
Lutterworth	6	3	2 6 0	6 15 0	12 14 0	„ Parsons.
Macclesfield	6	4	3 16 0	54 3 0	88 10 0	Dr. Fletcher.
Maldon	3	6	3 4 0	15 14 0	52 6 0	„ Copeman.
Manchester	3	3	31 3 0	62 5 0	148 5 0	„ Airy.
Mansfield	6	3	12 0 0	46 9 0	79 16 0	„ Bruce Low.
Market Bosworth	6	4	0 19 0	10 18 0	23 3 0	„ Parsons.
Market Harborough	5	—	—	—	—	Do.

App. A. No. 2.

Inspection of Public Vaccination.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Melton Mowbray - -	7	5	1 19 0	7 1 0	21 13 0	Dr. Bulstrode.
Merthyr Tydfil - -	11	10	7 15 0	87 4 0	295 11 0	„ Fletcher.
Midhurst - - -	5	3	4 16 0	5 15 0	15 17 0	Mr. Sweeting.
Mitford and Launditch -	9	5	0 16 0	9 11 0	27 12 0	Dr. Airy.
Monmouth - -	6	4	3 7 0	29 12 0	50 3 0	„ Fletcher.
Nantwich - -	8	5	5 18 0	15 18 0	43 12 0	Dr. Fletcher.
Narberth - - -	4	2	11 18 0	13 4 0	25 2 0	Do.
Neath - - -	6	4	31 3 0	40 1 0	143 14 0	Do.
Newark - - -	8	6	0 19 0	38 7 0	56 15 0	„ Bruce-Low.
Newcastle-in-Emlyn -	3	3	13 17 0	23 12 0	56 9 0	„ Fletcher.
Newcastle-on-Tyne -	3	4	15 18 0	45 8 0	111 13 0	„ Airy.
New Forest - -	5	3	1 3 0	10 13 0	17 3 0	Mr. Sweeting.
Newhaven - -	5	2	1 1 0	2 15 0	3 16 0	Do.
Newport (Mon.) - -	9	5	1 16 0	42 13 0	117 2 0	Dr. Fletcher.
Newport Pagnell -	10	3	1 5 0	8 17 0	14 14 0	„ BruceLow.
North Bierley - -	13	6	1 16 0	13 15 0	54 15 0	„ Theo. Thomson.
Northwich - -	5	4	26 17 0	39 9 0	124 7 0	„ Fletcher.
Norwich - - -	1	1	—	—	105 17 0	„ Airy.
Nottingham - -	3	4	16 18 0	76 10 0	160 2 0	„ BruceLow.
Olave, St. - - -	3	3	31 0 0	63 8 0	154 4 0	Dr. Airy.
Ongar - - -	4	3	5 17 0	8 4 0	21 18 0	„ Copeman.
Orsett - - -	5	4	4 11 0	22 19 0	47 17 0	Do.
Paddington -	1	1	—	—	82 4 0	Dr. Airy.
Pancras, St. - -	1	1	—	—	163 7 0	Do.
Pembroke - - -	6	3	8 8 0	46 1 0	65 10 0	„ Fletcher.
Penistone - - -	3	3	4 7 0	16 18 0	27 12 0	„ Theo. Thomson.
Penrith - - -	6	3	5 10 0	7 5 0	19 10 0	Mr. T. W. Thompson.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Petworth - - -	4	3	4 7 0	9 1 0	21 13 0	Mr. Sweeting.
Pontardawe - -	2	2	41 16 0	45 0 0	86 16 0	Dr. Fletcher.
Pontypool - - -	4	1	—	—	34 1 0	Do.
Pontypridd - -	9	7	12 2 0	90 11 0	374 3 0	Do.
Poplar - - -	4	4	38 11 0	106 15 0	235 9 0	Mr. Sweeting.
Prestwich - - -	6	5	6 10 0	86 1 0	247 4 0	„ T. W. Thompson.
Rhayader - - -	2	2	6 1 0	10 15 0	16 16 0	Dr. Fletcher.
Rochford - - -	6	3	7 10 0	25 15 0	42 2 0	„ Copeman.
Romford - - -	6	4	1 19 0	44 7 0	102 19 0	Do.
Rotherham - -	8	7	3 15 0	32 0 0	198 2 0	„ Theo. Thomson.
Runcorn - - -	4	3	9 12 0	48 13 0	66 7 0	„ Fletcher.
Rye - - -	3	1	—	—	3 15 0	Mr. Sweeting.
Saffron Walden - -	6	6	2 4 0	24 1 0	54 14 0	Dr. Copeman.
Salford - - -	4	4	21 7 0	62 2 0	155 1 0	„ Airy.
Saviour, St. - -	5	5	69 3 0	91 12 0	400 6 0	Do.
Sevenoaks - - -	6	2	11 15 0	12 17 0	24 12 0	Mr. Sweeting.
Sheffield - - -	6	5	11 16 0	72 6 0	220 5 0	Dr. Airy.
Shepton Mallet - -	5	2	1 12 0	2 7 0	3 19 0	Mr. Sweeting.
Sherborne - - -	3	3	6 15 0	9 13 0	22 6 0	Dr. Fletcher.
Shoreditch - -	3	3	46 14 0	91 17 0	201 17 0	Mr. Sweeting.
Stamford - - -	7	4	3 3 0	10 12 0	30 16 0	Dr. BruceLow.
Smallburgh - -	4	3	5 18 0	14 6 0	33 2 0	„ Airy.
Southampton - -	2	2	29 0 0	75 10 0	104 10 0	Mr. Sweeting.
South Stoneham - -	6	5	9 0 0	35 9 0	98 17 0	Do.
Southwell - - -	7	5	1 6 0	9 9 0	27 1 0	Dr. Bruce Low.
Spalding - - -	9	3	3 0 0	4 5 0	13 14 0	Do.
Spilsby - - -	7	6	3 11 0	7 7 0	36 11 0	Do.
Steines - - -	7	3	4 18 0	11 11 0	24 15 0	Do.
Stamford - - -	7	5	0 3 0	11 12 0	18 15 0	Do.
Stepney - - -	1	1	—	—	92 17 0	Mr. Sweeting.
Steyning - - -	6	2	6 12 0	12 17 0	19 9 0	„ Do.
Stockport - - -	3	4	2 13 0	32 16 0	79 0 0	„ T. W. Thompson.
Strand - - -	1	1	—	—	15 18 0	„ Sweeting.
Strand - - -	2	2	30 12 0	55 11 0	95 3 0	Do.

App. A. No. 2.

Inspection of Public Vaccination.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Swaffham	6	5	1 3 0	8 11 0	18 8 0	Dr. Airy.
Swansea	5	3	29 4 0	91 8 0	171 13 0	„ Fletcher.
Tarvin	2	2	11 6 0	16 19 0	28 5 0	Mr. T. W. Thompson.
Taunton	7	4	9 9 0	21 10 0	62 1 0	„ Sweeting.
Tendring	11	4	7 14 0	31 12 0	69 9 0	Dr. Copeman.
Thakeham	2	2	9 19 0	12 1 0	22 0 0	Mr. Sweeting.
Thetford	6	5	1 3 0	11 3 0	24 5 0	Dr. Airy.
Ticehurst	8	5	0 13 0	6 13 0	18 11 0	Mr. Sweeting.
Toxteth Park	2	2	39 4 0	52 15 0	91 19 0	Dr. Airy.
Tregaron	2	1	—	—	9 17 0	„ Fletcher.
Uckfield	6	4	3 18 0	10 6 0	33 5 0	Mr. Sweeting.
Uxbridge	7	6	2 15 0	13 3 0	48 19 0	Dr. BruceLow.
Walsingham	6	2	9 11 0	9 12 0	19 3 0	Dr. Airy.
Wandsworth and Clapham.	7	6	11 4 0	100 19 0	278 19 0	Do.
Wayland	2	2	11 16 0	11 18 0	23 14 0	Do.
Wellington (Som.)	5	5	6 0 0	16 1 0	44 10 0	Mr. Sweeting.
Wells	4	2	15 8 0	18 0 0	33 8 0	Do.
Westbourne	3	3	1 18 0	8 5 0	17 10 0	Do.
West Derby	7	6	34 4 0	133 14 0	362 19 0	Dr. Airy.
West Firle	3	1	—	—	1 2 0	Mr. Sweeting.
West Ham	9	8	11 14 0	87 4 0	401 8 0	Dr. Airy.
West Hampnett	5	3	5 1 0	9 6 0	21 18 0	Mr. Sweeting.
Westminster	1	—	—	—	—	Dr. Airy.
West Ward	4	—	—	—	—	Mr. T. W. Thompson.
Whitchurch (Hants)	3	3	1 7 0	7 13 0	14 17 0	„ Sweeting.
Whitechapel	1	1	—	—	191 6 0	Dr. Airy.
Wight Isle of	9	8	2 6 0	28 2 0	112 16 0	Mr. Sweeting.
Wigton	6	2	7 14 0	7 18 0	15 12 0	„ T. W. Thompson
Williton	7	6	1 17 0	15 1 0	43 19 0	„ Sweeting.
Wincanton	6	4	1 17 0	11 15 0	27 3 0	Do.
Winchester, New	4	4	6 1 0	36 10 0	61 6 0	Do.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Winslow - - -	3	3	1 10 0	2 14 0	5 15 0	Dr. BruceLow.
Wirral - - -	4	2	9 4 0	21 16 0	31 0 0	„ Fletcher.
Worksop - - -	7	6	1 17 0	34 9 0	86 7 0	„ BruceLow.
Wortley - - -	4	4	4 7 0	34 0 0	73 17 0	„ Theo. Thomson.
Wycombe - - -	10	8	2 9 0	24 19 0	75 9 0	„ BruceLow.
Yarmouth, Great -	2	2	14 3 0	54 6 0	68 9 0	Dr. Airy.
Yeovil - - -	7	5	4 13 0	28 6 0	65 8 0	Mr. Sweeting.
Total - -	1,247	855	—	—	15,288 16 0	

App. A. No. 3.
National Vaccine Establishment.

No. 3.

Statistics of the National Vaccine Establishment and Educational Vaccination Stations.

I.—Staff at end of 1892.

N.B.—The Stations named in *italics* are Educational Vaccination Stations authorised by the Local Government Board.

Description of Vaccinator.	Name of Vaccinator.	Vaccination Stations.	Days and Hours of Attendance.
Vaccinators supplying lymph for the public service, & salaried from the Parliamentary grant.	1. Dr. R. Cory	*Surrey Chapel*	Tues., Thurs.; 2.
	2. Mr. Joseph Loane	*Tottenham Court Chapel.*	Mon., Wednes.; 1.
Parochial and other Vaccinators not salaried from the Parliamentary grant, but contributing lymph at a fixed rate of payment.	1. Mr. Ellis S. Guest	*Manchester*	Monday; 2.
	2–6. Dr. Edmund Robinson.	*Birmingham*	Monday Tuesday Wednesday } 11. Wednesday; 2. Thursday; 11.
	7. Mr. N. E. Roberts	*Liverpool*	Tuesday; 1.
	8. Mr. E. L. Webb	*Pimlico*	Thursday; 10.
	9. Mr. J. Hawthorn	*Newcastle-on-Tyne.*	Wednesday; 3.
	10. Mr. E. L. Webb	Westminster	Tuesday; 10.
	11–12. Mr. E. C. Greenwood	*Marylebone*	Tuesday; 2. Wednesday; 10.
	13. Mr. J. Loane	*Whitechapel*	Wednesday; 11.
	14. Mr. Frederick Holmes	*Leeds*	Tuesday; 2.30.
	15. Dr. Edward Lynes	Coventry	Tuesday; 12.
	16–17. Dr. Hugh Thomson	*Glasgow*	Monday; 2. Mon., Thurs.; 12.
	18. Mr. J. F. Staines	*Endell Street*	Tuesday; 10.
	19. Mr. W. Skinner	*Sheffield*	Tuesday; 3.
	20. Dr. A. C. Clarke	Salford	Thursday; 2.
	21. Dr. G. A. Miskin	Waterloo	Tuesday; 2.
	22. Dr. J. B. Buist	*Edinburgh*	Thursday; 3.
	23. Dr. R. Cory	*St. Thomas's Hosp.*	Wednesday; 11.30.
	24. Mr. Wm. McLennan	*Glasgow West*	Monday; 1.
Teachers of Vaccination not supplying lymph.	Dr. W. Husband	*Edinburgh*	Wednes., Sat.; 12.
	Mr. H. Lawrence	*Bristol*	Wednesday; 10.
	Mr. William A. Budd	*Exeter*	Thursday; 3.
	Mr. V. A. Jaynes	*Horsleydown*	Wednesday; 3.
	Dr. A. N. Montgomery	*Dublin*	Tues., Fri.; 10.
	Dr. R. Cory	*Cambridge*	Friday; 11.

II.—Animal Vaccine Station.

The Animal Vaccine Station is at 95, Lamb's Conduit Street, where Dr. R. Cory and Mr. T. S. Stott attend for the Vaccination of Children on Tuesdays and Thursdays, at 10.30 a.m.

III.—Sources and Amount of Humanised Lymph Supply in 1892.

N.B.—The Stations named in *italics* are Educational Vaccination Stations authorised by the Local Government Board.

Description of Vaccinators.	Vaccination Stations.	Number of Vaccinations performed at the Stations respectively.		Number of Charges of Lymph supplied from the Stations respectively.	
		Primary.	Re-vaccinations.	Charged Ivory Points.	Charged Tubes each estimated as equal to 10 Ivory Points.
Vaccinators salaried from the Parliamentary grant.	1. *Surrey Chapel*	158	11	353	—
	2. *Tottenham Court Chapel.*	301	17	—	154
	Total -	459	28	353	154
Parochial and other Vaccinators not salaried from the Parliamentary grant, but contributing lymph at a fixed rate of payment.	1. *Manchester* -	824	5	—	347
	2–6. *Birmingham* -	3,358	202	—	825
	7. *Liverpool* -	504	92	—	105
	8. *Pimlico* - -	329	6	—	53
	9. *Newcastle-on-Tyne.*	527	28	—	192
	10. Westminster -	532	26	—	32
	11–12. *Marylebone*	601	66	—	29
	13. *Whitechapel* -	2,041	7	—	694
	14. *Leeds* - -	789	5	—	—
	15. Coventry -	34	7	—	8
	16–17. *Glasgow* -	1,286	5	—	49
	18. *Endell Street* -	226	22	—	21
	19. *Sheffield* - -	797	2	—	89
	20. Salford - -	297	—	—	36
	21. Waterloo -	1,377	5	—	1,626
	22. *Edinburgh* -	403	1	—	—
	23. *St. Thomas's Hospital.*	201	7	—	—
	24. *Glasgow West* -	576	42	—	—
	Total -	14,702	528	—	4,106
	Grand Total -	15,161	556	353	4,260

App. A. No. 3.

National Vaccine Establishment.

III.—Sources and Amount of Humanised Lymph—*continued.*

During the year, additional supplies (to the extent of 3,566 charged tubes) were obtained from the following gentlemen:—

Dr. W. H. Kempster, Battersea East.
Dr. T. N. Orchard, Pendleton.
Dr. T. M. Johnson, Salford.
Mr. J. Bark, Kirkdale.
Dr. R. S. Archer, Everton.
Dr. F. Cadell, Edinburgh.
Mr. A. Meeson, Toxteth Park.
Dr. R. F. Cook, Gateshead.
Dr. G. A. Miskin, Kennington.
Mr. H. E. Hackett, Gorton.

IV.—Distribution of Human Lymph, 1892.

Number of applications:

From Medical Practitioners in England and Wales	4,233
„ „ „ Scotland	210
„ the Army	3
„ the Navy and from the Emigration Department	43
„ India and the Colonies	3
„ Diplomatic and other Foreign Services	22
Supplies sent out:—	
Charged ivory points	338
„ capillary tubes	6,562

V.—Distribution of Calf-Lymph, 1892.

Number of applications	2,992
Supplies received:—	
Charged ivory points	11,908
„ capillary tubes	65
Supplies sent out:—	
Charged ivory points	12,056
„ capillary tubes	65

No. 4.

REPORT on the OPERATIONS of the ANIMAL VACCINE STATION at LAMB'S CONDUIT STREET, during the Year 1892-93; by Dr. ROBERT CORY.

During the year 1st April 1892 to the 31st March 1893, 270 calves were vaccinated at Lamb's Conduit Street, for the purposes of the station.

The aggregate weight on reception at Lamb's Conduit Street of the 270 calves was 200 male, 56,459 lbs., 70 female, 20,414 lbs. On dismissal from the station their weights were respectively 61,484 lbs. and 21,943 lbs., so that during retention for vaccination purposes calves of both sexes gained considerably in weight, males by an average of 25·12 lbs., females by an average of 21·84 lbs. Of the above vaccinated calves, 257 were vaccinated with lymph directly derived from other calves, and 13 were vaccinated with calf lymph which had been stored.

Seven hundred and twenty-three insertions in 13 calves vaccinated with stored lymph produced 637 vesicles, whereas 16,581 insertions in 257 calf-to-calf operations produced 14,474 vesicles; rates of insertion success respectively of 88·1 and 87·3 per cent. No material difference in the results of calf-to-calf vaccinations were observed whether the lymph used was from calves vaccinated 96, or from calves vaccinated 120 hours previously; in both cases the rate of insertion success was practically 87 per cent.*

Primary Vaccinations.—During the year 1892-93, 7,616 persons received primary vaccination at the station, five separate insertions of lymph being made in each instance. Of these, 3,788 were males and 3,828 females; all but 38 of 7,520 primary vaccinations which returned for inspection succeeded at the first attempt, and in no case was a third attempt at vaccination requisite. The amount of insertion success obtained by each of three several operators was as follows:—

Of 279 persons primarily vaccinated by Mr. Stott, three failed to return for inspection. Of the remaining 276, 210 were on examination found to have taken in five places, 33 in four, 15 in three, 8 in two, 10 in one. Mr. Stott's insertion success rate, therefore, was 90·8 per cent.

Of 746 persons primarily vaccinated by Dr. Savory, acting for Mr. Stott, or myself in the absence of one or other of us, seven failed to return for inspection, and three were vaccinated round nævi. Of the remaining 736, 611 were found to have taken in five places, 50 in four, 29 in three, 19 in two, 17 in one, while 10 did not take on the first attempt. Dr. Savory's success, therefore, was 92·3 per cent.

Of 6,591 persons primarily vaccinated by myself, 67, who failed to return for inspection and other 16, all of whom were operated on

* The ratio of insertion-success is, it will be observed, considerably below that of previous years. This has been, in the main, due to the circumstance that during part of the year the calves operated on were not of the class best adapted for the purposes of the station. The contractor having died, his successor was unable for a time to meet the requirements *of the Establishment* in this respect.

for the cure of nævi, are not taken into account in these statis
Of the 6,508 remaining, 5,931 were found to have taken in
places, 322 in four, 118 in three, 67 in two, 42 in one only, v
in 28 cases vaccination proved unsuccessful on first trial,
insertion success rate of 96·7 per cent.

Revaccinations.—These during the year numbered 688. Mr. S
performed 31, and Dr. Savory 45, and I myself 612. Of these
501 were successful in five places, 40 in four, 11 in three, 6 in
6 in one, 14 were unsuccessful, and other 34 did not return
inspection. My insertion success rate, therefore, in revaccination
93·98 per cent. Mr. Stott's success rate among his 31 cases, w
returned for inspection, was 99·21 per cent., and Dr. Savory's inse
success rate was 88·64.

In all, 73 cases returned to the station after "inspection" on acc
of some abnormal course of their vaccinations. In the majority of
the abnormality consisted of sore arm, which was almost invariably
result of ignorant treatment of the vesicle or of the scab. For the
there were 20 cases of transient eruption, five cases of axillary ab
(following sore arms), and five cases of erysipelas (also complica
sore arms).

There was one case of death alleged to have been caused by vaccina
This was a child, born on the 20th September 1892, vaccinated on
2nd February and who died on the 28th March 1893. An inquest
held on the case. At the post-mortem, which was attended by me
evidence of pyæmia or erysipelas was found, but the base of the r
lung was congested, and portions of the lung thus affected sank w
placed in water. There was no enlargement of the axillary gland
œdema of the vaccinated side present, and no enlargement of
joints. The jury returned a verdict of death from natural causes.

No. 5.

Abstract of Medical Inspections.

Abstract of Medical Inspections made in 1892 with regard to the Incidence of Disease on particular places, and to questions concerning Local Sanitary Administration.

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1. Ashby de la Zouch Rural Sanitary District (Leicestershire); population (1891), 24,055; Dr. Parsons.

Sanitary Authority: Ashby de la Zouch R.*

Ground of Inquiry: Enteric fever and diphtheria. Registrar-General's Returns.—Reports of Medical Officers of Health and local complaints.

Chief Facts reported by Inspector: The endemic prevalence of enteric fever confined to Coalville (population about 6,000), a coal mining town of modern origin, situated in several parishes and jurisdictions and in need of unified urban administration (a local board about to be formed). Sewers and drains, with some exceptions, defective. Midden and cesspit privies wet and offensive, and often overfull. No public scavenging; frequent difficulty in procuring removal of refuse by farmers, and hence night soil often disposed of on gardens near to houses and wells. Water supply from private wells liable to pollution; no public service. Enteric fever existed in Coalville more or less throughout 1891, but several sudden outbursts occurred in particular localities, caused probably by specific contamination of individual wells. The fatal cases of diphtheria occurred in the same localities as the enteric fever.

An outbreak at Griffydam of infectious throat illness of obscure nature, by one medical man regarded as diphtheritic; in some cases associated with defective sanitary conditions and a particular milk supply.

Rural Sanitary Authority have a fever hospital, but of defective design and little used.

2. Ashby Woulds (Leicestershire); population (1891), 3,214; Dr. Parsons.

Sanitary Authority: Ashby Woulds U.*

Ground of Inquiry: Enteric fever.—Report of Medical Officer of Health.

Chief Facts reported by Inspector: A severe but circumscribed outbreak of enteric fever at Newfield, Moira, extending over three months, and limited to two rows of houses. First cases possibly contracted in Burton-on-Trent. Water supply scanty and difficult of access, and milk supply from a dairy farm at which well was polluted, but both supplies common to a number of other houses which escaped fever. Spread of fever not explicable by defects of drainage or common use of privies; probably due to direct contact with specific infection, favoured by common use of washhouse, foul state of unpaved yard, and careless habits of mining population. No means of isolation available.

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* Throughout this abstract "*R.*" denotes "Rural Sanitary Authority," and "U." "Urban Sanitary Authority."

App. A. No. 5.
Abstract of Medical Inspections.

3. Brownhills (Staffordshire); population (1891), 13,703; Mr. T. W. Thompson.

Sanitary Authority: Brownhills U.

Ground of Inquiry: Representation by County Council as to default of Sanitary Authority in carrying out the Public Health Acts.

Chief Facts reported by Inspector: Houses often unspouted, defectively drained, and consequently liable to be damp. Yards mostly unpaved and ashes often heaped up or strewed about them. In some cases pools of slop sewage standing in proximity to houses. Water supply mainly from wells of defective construction and surrounded in many cases by obvious sources of pollution. District insufficiently sewered. Slop water in most of district, except Brownhills village, conveyed by open and frequently defective channels to small badly constructed catchpit cesspools often near to dwellings. Middens in almost universal use for excrement and refuse disposal. Middens of excessive size, deep, often uncovered, and in most cases wet and offensive. Scavenging recently taken over by Sanitary Authority and let to four contractors. Scavenging, however, still unsatisfactory.*

4. Cameley Parish (Somerset); population (1891), 465; Dr. Sweeting.

Sanitary Authority: Clutton R.

Ground of Inquiry: Enteric fever at Temple Cloud. Local complaints and reports.

Chief Facts reported by Inspector: Eleven cases and two deaths from enteric fever; early cases associated with grossly unwholesome circumstances of water supply and excrement disposal; later cases probably directly infected from the earlier owing to non-disinfection of stools. Water supply from shallow wells and open dipping places. Drainage by rude rubble pipes to streams and ditches. Excrement received in privy pits, many of them overflowing to streams. Inefficient sanitary administration. Adoption of the Infectious Disease (Notification) Act quite recent.

5. Hendon Rural Sanitary District (Middlesex); population (1891), 13,834; Dr. Bruce Low.

Sanitary Authority: Hendon R.

Ground of Inquiry: Continued prevalence of scarlatina and diphtheria.—Local complaints.

Chief Facts reported by Inspector: Both diseases prevalent in district during last two years. Some localisation of both ailments at Harrow Weald. Scarlatinal infection imported from London in 1891. Type of epidemic mild. Only three deaths out of 160 recorded cases. Diphtheria has appeared from time to time in district during late years. It also followed scarlatinal outbreak at Harrow Weald. During two years, 110 cases reported in the district, and of these 12 were fatal. Both diseases spread mainly by personal contact.

No hospital provision or proper disinfecting apparatus established by Rural Sanitary Authority. Absence of efficient scavenging. Insufficient flushing of many w.c.'s. Slaughter-houses not regulated. Dairies, Cowsheds, and Milkshops Order of 1885 not enforced.

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* *Reprinted* as App. A. No. 10 of present volume.

6. Heywood (Lancashire); population (1891), 23,286; Mr. T. W. Thompson.

Sanitary Authority: Heywood U.

Ground of Inquiry: Diphtheria.—Registrar-General's Returns and Reports of Medical Officer of Health.

Chief Facts reported by Inspector: Recognised diphtheria, which had been present in district during three preceding years, became notably more prevalent towards end of 1890. Increased prevalence maintained to date of inquiry—March 1892. Undefined throat ailment also common. Spread of diphtheria apparently due to infection from case to case. School influence seemingly played a part, as also, probably, the close association of young persons in mills and factories. No evidence obtained of dissemination by milk, domestic animals, or water. No means of isolation in district, and sulphur fumigation relied on for disinfection of clothes and bedding. Many invaded houses damp. Sewers deficiently ventilated. A number of old privy middens of very objectionable type still in district, though pail closets largely adopted, and water-carriage system now being introduced. Scavenging undertaken by Sanitary Authority, but not satisfactorily carried out. Night soil disposed of to farmers, but ashpit refuse deposited at "tips" in or near the town. Scores of houses built on "made" soil thus formed.

7. King's Lynn; population (1891), 18,265; and Gaywood (Norfolk), 952; Dr. Bruce Low.

Sanitary Authorities: King's Lynn U. and Freebridge Lynn R.

Ground of Inquiry: Epidemic of typhoid fever.—Report of Medical Officer of Health.

Chief Facts reported by Inspector: (*a.*) King's Lynn.—Sudden outbreak of diarrhœa attacking all classes and all parts of the town during last few days in February, followed by development of numerous typhoid cases about a fortnight later. Town's water supply derived from Gaywood river, which flows to town through cultivated fields and gardens. The intake is within borough boundary. Filtration very insufficient. Town's manure containing contents of privy pits, into which the discharges of some typhoid cases had been thrown, spread antecedent to the outbreak on part of a market garden in Gaywood abutting upon the river and about a mile above the intake. Excreta from a house outside Gaywood, wherein eight persons were attacked one after the other with typhoid fever, between November and March, had been placed in a pit in the garden from which it was washed into the river above the intake by the melted snow and heavy rainfall that occurred in the third week of February.

Excrement disposal is by w.c.'s and by pit privies; the latter are being rapidly replaced by the former. Sewers tide-locked for several hours daily, defective gradients in one particular section. Deposit occurs in nearly all. There are some 12 separate outfalls into River Ouse or its tributaries. A new water supply *urgently needed.*

(*b.*) Gaywood.—Practically a suburb of King's Lynn; mostly same sewerage and water supply. Few scattered cases of typhoid in Gaywood in November and December, with greater prevalence in March and later coincidently with epidemic prevalence of same disease in King's Lynn, and referable to like causation.*

8. LAKENHEATH (Suffolk); population (1891), 1,850; Dr. Copeman.

Sanitary Authority: Mildenhall R.

Ground of Inquiry: Diphtheria.—Registrar-General's Returns.

Chief Facts reported by Inspector: Endemic throat illness, increasing in extent during the last four years. Special incidence of fatal attacks upon children. Notification only recently put in force, so no trustworthy data as to prevalence of non-fatal throat illness. No hospital provision in the district. Water supply of Lakenheath from surface wells on sloping ground. Above level of majority of these is overstocked churchyard, by which wells are probably contaminated. All samples of water examined condemned as unfit for drinking purposes. No sewerage system; privy midden universal. Nuisances from storage of household refuse in neighbourhood of dwellings. Dwellings of poor in bad sanitary condition.

9. LIMPSFIELD: Church Missionaries' Children's Home (Norfolk); Dr. Copeman.

Sanitary Authority: Godstone R.

Ground of Inquiry: Diphtheria.—Requisition of inhabitants of Limpsfield.

Chief Facts reported by Inspector: Endemic throat illness among children of feeble vitality, congregated together in the same building. Recrudescence of undoubted diphtheria on two occasions; 22 cases in all. Buildings modern; situation high (700 feet) and exposed; sanitary arrangements good. Sanatorium detached from main block. Water and milk supplies good. Drainage of Home disposed of by subsoil irrigation on estate at considerable distance from buildings.

10. MONMOUTH REGISTRATION DISTRICT; population (1891), 28,281; Dr. Fletcher.

Sanitary Authorities: Monmouth U. and R. and Coleford U.

Ground of Inquiry: Diphtheria.—Registrar-General's Returns.

Chief Facts reported by Inspector: (*a.*) Monmouth U.—A few cases of "croup" during 1888, followed by three cases of diphtheria in 1889; then disappearance of the disease till the latter part of 1890, when it assumed epidemic form, and has since remained endemic. About two-thirds of persons attacked were children of school age.

No hospital accommodation available. Water supply apparently good and ample, but not in use in some households, even in the town. Sewers badly constructed, badly ventilated, and inadequate; outfalls into Rivers Monnow and Wye, sewage being discharged without treatment. Closet accommodation very bad. No scavenging by Sanitary Authority. Indifference and neglect of duty by the Sanitary Authority.

* Reprinted as App. A. No. 8 of present volume.

(*b.*) Monmouth R.—Throat disease endemic for some years, many cases being recognised as diphtheria. Occasional outbreaks in epidemic form. Spread through school attendance. Details regarding outbreaks prior to August 1892 unsatisfactory, owing to neglect to register the cases.

No hospital accommodation. Water supply deficient in various parts of the district. Neglect of Sanitary Authority to provide water. No systematic sewerage. Little provision for getting rid of house-slops, and that of an unsatisfactory kind. Attention of Sanitary Authority required urgently in this respect in the more populous parts of the district. Closet accommodation chiefly by privies with deep pits. Sanitary Authority do not scavenge. Many houses damp, some dilapidated, and some occupied though quite unfit for habitation.

(*c.*) Coleford U.—Diphtheria epidemic during latter half of 1890. Epidemic dependent on school influences. A few cases during 1891 and 1892.

No hospital accommodation. Water supply said to be good and ample, but distribution very imperfect. Sewerage very inadequate, no proper system. Present sewers consist of covered water-courses. Closet accommodation mostly by privy pits. Practically no removal of refuse by Sanitary Authority.

11. NEW QUAY (Cardiganshire); population (1891), 1,284; Dr. Fletcher.

Sanitary Authority: New Quay U.

Ground of Inquiry: Unsatisfactory reports of Medical Officer of Health, and inactivity of the Sanitary Authority.

Chief Facts reported by Inspector: House accommodation not altogether satisfactory. No properly distributed water supply. No properly constructed sewers. Drainage of domestic premises deficient. Excrement disposal unsatisfactory; no scavenging by the Sanitary Authority; many dwellings without privy accommodation. Compulsory notification not in force. Infectious Disease (Prevention) Act, 1890, and Public Health Acts Amendment Act, 1890, not adopted. No isolation hospital, and no disinfecting apparatus. No byelaws. Officers inadequately remunerated.

12. WIGAN; population (1891), 55,013; Ince-in-Makerfield; population (1891), 19,255; Dr. Copeman.

Sanitary Authorities: Wigan U. and Ince-in-Makerfield U.

Ground of Inquiry: Typhus.—Registrar-General's Returns.

Chief Facts reported by Inspector:—(*a.*) Wigan.—Prevalence of typhus in Wigan and adjoining district of Ince-in-Makerfield. Over 70 cases reported, with 10 deaths. Special incidence of disease on St. Patrick's Ward, a district of Wigan, inhabited by miners chiefly of Irish extraction. Disease probably introduced by navvy from Liverpool. A number of "back-to-back" houses in district. Privy accommodation deficient and in bad order. Household refuse often stored in disused basement of dwellings. Overcrowding; dirt and destitution prevalent. Hospital provision at Wigan satisfactory, which enabled Sanitary Authority to effectually cope with outbreak. Infectious Diseases (Notification) Act in force in district.

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(*b.*) Ince-in-Makerfield.—Spread of the typhus by direct personal infection from immediately adjacent borough of Wigan. Hospital provision available, but of defective character; wards built "back-to-back;" nursing arrangements unsatisfactory.*

13. York Rural Sanitary District; population (1891), 14,511; Mr. T. W. Thompson.

Sanitary Authority: York R.

Ground of Inquiry: Need for further information as to sanitary state of district.

Chief Facts reported by Inspector: Dampness in and around dwellings frequently met with as result of defective roofing or flooring, absence of eave-spouting, or want of proper yard paving. Some houses unfit for habitation. Water-supply mostly from pump or "draw" wells, inadequately protected against percolation from the surface soil, and in many instances situated near to sources of pollution, such as privies, middens, pigstyes, and fold-yards. Villages almost all provided with sewers of some sort, though often of a very unsatisfactory character. Sewers generally without provision for flushing and deficiently ventilated. Large catchpits in course of many of them. Except at Clifton (where the sewers are connected with those of an urban authority) sewage is turned crude into neighbouring watercourses. Excrement and refuse disposal usually by midden privies, many of which are large, deep, and badly placed. A good number, however, are roofed over, and some of those most recently constructed are rendered in cement. Scavenging left to occupiers, and hence considerable accumulations of ashes and refuse. Sanitary Authority have adopted the Infectious Disease (Notification) Act, but have not provided an isolation hospital or disinfecting apparatus. Their byelaws are out of date. Action of Sanitary Authority hitherto inadequate to needs of the district.

* Reprinted as App. A. No. 9 of present volume.

No. 6.

Introduction to Dr. Barry's Report on Enteric Fever in the Tees Valley, 1890–91; by the Medical Officer.

INTRODUCTION to Dr. BARRY'S REPORT on ENTERIC FEVER in the TEES VALLEY, 1890–91, addressed by the MEDICAL OFFICER to the PRESIDENT OF THE LOCAL GOVERNMENT BOARD (August 1893).

IN presenting his Annual Report on the proceedings of the Medical Department during the year 1890, my predecessor, Sir George Buchanan, submitted, in the following words, an Interim Report by Dr. Barry on an epidemic prevalence of Enteric Fever in the Valley of the Tees:—

"I would . . . direct special attention to Dr. Barry's Interim Report on an epidemic prevalence of Enteric Fever in the Valley of the Tees, reserving his complete report until he shall be able to use the facts of the new Census. Dr. Barry gives an account of an outburst of Enteric Fever in the Tees Valley occurring immediately after a heavy flood of the river, and selecting simultaneously those districts which procured their drinking water from a certain section of the Tees. The circumstantial evidence of a relation between the fever and the water supplies was such as might have sufficed to implicate the one as a cause of the other. But furthermore we are told that no other common condition belonging to the several districts could be discovered, bar that of water supplies from the same part of the Tees; and presently we learn that the river, before it reaches this place, habitually receives in abundance the excrements of people higher up the stream. This fact was perfectly well known in the districts which derive their drinking water from this part of the river. It was well for Stockton, Middlesbrough, and Darlington that the specific poison contained in the excrements befouling the Tees in 1890 was not that of Asiatic Cholera."

The interest attaching to the circumstances of this epidemic was, however, materially enhanced by reason of the fact that whilst the Interim Report was passing through the press a second outburst of Enteric Fever occurred in the Valley of the Tees, its incidence being, as was the case during the first epidemic prevalence, special to localities deriving their water supply from the River Tees. The excess of Enteric Fever attacks occasioning the first outburst was most marked during a six weeks' period, 7th September—18th October 1890; that occasioning the second outburst during a six weeks' period, 28th December 1890—7th February 1891. Both outbursts are dealt with by Dr. Barry in the annexed report; the statistical evidence bearing upon each being based on the detailed results of the Census of 1891.

Dr. Barry's Report has concern primarily with 10 Registration Districts lying immediately to the north and to the south of the River Tees, and having together a population of 503,616 (1891); these 10 districts forming part of a large area in Northumberland, Durham, and Yorkshire, in most of which, according to the Registrar-General, Enteric Fever has been unduly prevalent during recent years. By the aid of returns made under the Infectious Disease (Notification) Act, 1889, supplemented by special returns from Medical Officers of Health and from Medical Practitioners, where the provisions of that Act were not in operation, it transpired that 1,463 cases of Enteric Fever occurred in

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these 10 Registration Districts in the two six-weeks' periods referred to; and that of these 1,463 cases, 1,334, or 91 per cent., occurred in three Registration Districts, namely, those of Darlington, Stockton, and Middlesbrough. Indeed the rates of attack from Enteric Fever per 10,000 of the population, in the first and the second of the two six-weeks' periods, were 29 and 24 respectively on the population of 251,976 living in the Darlington, Stockton, and Middlesbrough Registration Districts combined, whilst the corresponding rates were 3·5 and 1·5 on the population of 251,640 living in the remaining seven Registration Districts. And, after adding to each of the two six-weeks' periods a further period, with a view of including, in each instance, the fever deaths referable to attacks during the outbursts in question, it was found that in two periods of 3½ months each, one terminating in the second week of December 1890, and the other in the third week of March 1891, the death rate from Enteric Fever in the three first-named Registration Districts was in the former more than three times, and in the latter five times greater than in the other seven Registration Districts. In short, whether judged by attacks or by deaths, there was in a group of 10 Registration Districts, the majority of which had, according to the Registrar-General, habitual excess of Enteric Fever, a quite exceptional excess during the two periods referred to in the Registration Districts of Darlington, Stockton, and Middlesbrough. And not only so, but in no other of the remaining seven Registration Districts did excess of Enteric Fever corresponding to these two outbursts take place at the periods in question.

The 10 Registration Districts referred to contain 32 Sanitary Districts, and when the incidence of the fever on Sanitary Areas was examined it was found that the excess of attack rate was limited to 10 out of the 32 Sanitary Districts; that 9 of the 10 were amongst the 11 Sanitary Districts comprised within the Registration Districts of Darlington, Stockton, and Middlesbrough; and that the remaining Sanitary District (Kirkleatham Urban, situate at the mouth of the Tees) was comprised in the Guisbrough Registration District, an area which, when taken as a whole, had not shown excess of fever incidence. Out of the 1,463 attacks of Enteric Fever in the two special periods 1,352, or 92 per cent., occurred in the 10 Sanitary Districts referred to. The rate of attack per 10,000 living was 31 and 26 respectively for the two six-weeks' periods in the 10 Sanitary Districts, whereas it was only 3 and 1 respectively in the remaining 22 Sanitary Districts. And it is noteworthy that, whether judged by attack or by death the special outburst of the fever in the 10 Sanitary Districts was most conspicuous as regards the second of the two epidemic periods—28th December 1890 to 7th February 1891—a period in which, as Dr. Barry points out, Enteric Fever is unapt to be epidemic in this country. Of the 10 Sanitary Districts which were especially involved in these epidemic outbursts, eight were Urban Districts, namely, Darlington, Stockton-on-Tees, Middlesbrough, South Stockton, Ormesby, Normanby, Eston, and Kirkleatham, and two were Rural, namely, Darlington and Stockton. In the Urban Districts the disease was general throughout their areas; in the Rural Districts it was limited to particular localities only.

Having ascertained that the special incidence of the fever during the two six-weeks' periods was upon these 10 Sanitary Districts, Dr. Barry made a careful inquiry into the general sanitary circumstances of these districts, dealing especially with the questions of house accommodation,

excrement and refuse disposal, and sewerage and drainage. He also inquired into the circumstances of milk distribution. As regards the latter, it will readily be understood that no community of milk supply could be discovered over the wide area involved. As regards general sanitary circumstances, a number of places were found more or less faulty. In one case fault related to house accommodation and to over-crowding of dwellings on area; in another it had to do with defective arrangements as to closet accommodation, whether waterclosets, pan-closets, or midden privies; in a third it was concerned with a deficient system of sewers or of drainage; and in yet another with two or more of these defects combined. But no community of any such sanitary circumstance could be found to affect the several areas invaded by the fever. And not only so, but amongst localities where precisely similar faults in one or other of the respects named, did prevail, some places suffered severely, whilst others enjoyed almost complete immunity from fever.

The matter was, however, quite different when the question of water supply came to be considered. There was found to exist in the 10 Sanitary Districts which suffered especially from fever a general community of circumstance in this respect, the water in question being pumped from the River Tees, and being, after a process of sand filtration, distributed either through the works of the Darlington Corporation or through those of the Stockton and Middlesbrough Water Board. The whole of the houses in the Urban Districts of Middlesbrough, Stockton-on-Tees, and South Stockton received this water, nearly the whole of the houses in the Urban District of Darlington, and about one-fifth of those in the Darlington Rural District were so supplied; and considerable portions of the Urban Districts of Normanby, Ormesby, Eston, Kirkleatham, and of the Rural Sanitary District of Stockton were similarly provided with water. In fact, out of a total of 93,974 inhabited houses (having in 1891 an enumerated population of 503,616 persons) in the 32 Sanitary Districts included within the 10 Registration Districts forming the area of inquiry, 39,566 (with an estimated population of 219,435 persons) were supplied with Tees water, and of this number all but 447 houses (with an estimated population of 2,072 persons) were within the 10 Sanitary Districts which were found to have suffered from excess of fever in the two epidemic periods. Here at last, in the matter of water supply, was a circumstance differentiating populations within the area under investigation. As already noted above, the estimated population receiving their water supply from the Tees amounted to 219,435, whereas the estimated population receiving their water supply from other sources than the Tees reached 284,181. Calculating the attack rates upon these figures, it was found that the rate of attack from Enteric Fever per 10,000 living during the first six weeks' epidemic had been 33 amongst persons supplied with the Tees water, and three amongst persons supplied with other water; whereas, in the second six weeks' epidemic, the rates were 28 and 1 respectively. Indeed, during two periods together, for every single person who contracted Enteric Fever amongst the population not using the Tees water, 15 contracted it amongst those who were supplied from the river.* Nearly parallel

* If it be contended that attack-rates based on notification returns made voluntarily cannot properly be compared with returns made under a compulsory system, a different comparison can easily be made by the aid of data supplied to me by Dr. Barry since the completion of his report. Certain Rural and Urban Sanitary

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Introduction to Dr. Barry's Report on Enteric Fever in the Tees Valley, 1890-91; by the Medical Officer.

results were obtained when the incidence of the disease on these populations was judged of as regards death from Enteric Fever.

The question, therefore, obviously arises: Were there any means by which the water delivered from the Tees could have served as a medium for conveying the specific contagion of Enteric Fever to its consumers?

Dr. Barry deals with this question at some length, and the answer to it is definite and unmistakeable. Within the catchment basin of the Tees, above the intakes of the two water companies, the river receives "either directly or indirectly the drainage of some 20 villages and "hamlets as well as that of the town of Barnard Castle," with its population of 4,341 (1891); besides washings of land heavily manured, at times with night soil, together with the drainage of graveyards and farmhouses. At Barnard Castle almost everything has been so contrived as to ensure, to the fullest, the fouling of the river by every conceivable form of filth. Reference to the Plates embodied in the report will show how public and private drains discharge upon the banks of the stream, whilst privies, urinals, and waterclosets deliver their contents on to the foreshore. No attempt whatever is made to hide or disguise the fact of pollution of the river at this point; a common arrangement being to carry all liquid filth to openings made at different altitudes in the house-walls, or in retaining walls, to discharge along the river side. The river, having thus been utilised as a common sewer, it has been found convenient to make it also serve the purpose of public scavenger, and as a consequence the banks were found to be lined here with "20 or more loads of stinking refuse," there with "very large quantities" of "ashes, house-refuse, waste building material, and "midden refuse," and yet further on with the refuse from gasworks, &c. At the date of Dr. Barry's visit, these masses "of stinking abominations" lay bare, exposed to the view of all, along the river banks awaiting the floods which periodically serve to wash the accumulated filth and refuse down stream as far as, and then beyond, the intakes of the two public water services. And Dr. Barry is not the only witness as to this well-nigh incredible condition of affairs. Thus, in 1875 the present Manager of the Stockton and Middlesbrough Water Board, then a member of the Middlesbrough Corporation, gave evidence before a Parliamentary Committee to the effect that the Tees was, at the point now in question, "an improper service" of water supply "from the pollutions that go "into the river." The present Chairman of the Board stated that there was "the very strongest objection" to a "water which is drawn from a "district above which there are 10,000 (now some 12,000) inhabitants "whose sewage is flowing into the river;" and a member of the Water Board declared that in view of what he had seen he had not drunk

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Districts within the Tees area, each of them partly supplied with Tees water and partly not, and in all of which compulsory notification was in operation, can be compared as to their "fever" according as the inhabitants within these areas were, or were not, supplied with Tees water. Of such Rural Sanitary Districts Dr. Barry finds that on 8,991 people supplied with Tees water, the attack-rate from Enteric Fever during the two six weeks' periods was 89·0 per 10,000 living, whereas on 14,442 people not supplied with Tees water the corresponding rate was only 6·2. Comparison of populations within such Urban Sanitary Districts gave similar results, and this, notwithstanding the inequality in the amount of the populations dealt with. Amongst 59,446 people who drank Tees water there were, during the same period, 304 attacks, or 51·1 per 10,000; whereas amongst persons not living in houses to which the Tees water was laid on, there were only six attacks, which gives a rate of 22·7 per 10,000. And all the six attacks were limited to the first of the two six weeks' epidemic periods.

r since, so satisfied was he that it was "not fit for use." Expert
e at different dates, some 10 or 15 years later, namely, between
d 1890, is all in the same direction; one witness testifies that the
le scene was "disgusting and offensive," including, as it did, masses
nseating odour and horrible appearance," together with cartloads
bish "laid down in readiness for a flood to remove them"; ·
· says that he "could scarcely have believed that such a dis-
ful state of pollution of a river could have existed at this time
ay (1887) anywhere in England," and that in times of flood "a
strong element of danger exists." And the conclusion based on
of bacteriological examinations of water, made during the same
to the effect that "in flooded states of the river there is evidence
ofound sewage contamination within the Darlington area" which
ts in the water of the Tees at the pumping station for the
ington town supply."

filth of such a character, in such abundance, and from such
, should remain for any length of time free from the specific
l of Enteric Fever could hardly be contended. As a matter of
e probabilities of the river receiving specific filth antecedent to
t outbreak are many; and it is known that numerous oppor-
for such specific fouling arose immediately before the second
e period.

st such a condition of things as is described can readily be under-
s conveying from time to time the particulate poison of Enteric
along with the Tees water, something more than the casual
n of the river water by the specific poison of that disease, which
e an ever recurring risk, seems needed in order to explain the two
onal outbursts with which Dr. Barry deals. Floods, occurring at
it moment, and carrying large masses of the filth with rapidity
he stream, up to, and past, the water intakes would however
a reasonable explanation of the exceptional outbursts of the
over the area supplied with the Tees water.

as a matter of fact, this is precisely what did happen. In the
ht ending August 23rd, 1890, no less than 3·660 inches of rain
gistered at Barnard Castle, and the river was recorded by the
or of the Tees Salmon Fishery Board as "much flooded" on
13th, and "very much flooded" on August 23rd. With the
September the first six weeks' epidemic set in.

ist the same way the second six weeks' epidemic period which
nced December 28th was preceded by flood in the Tees, namely,
ight foot flood in the beginning of December, due to melting of
nat had fallen in great abundance towards the end of November.

ummarise:—Over a wide area covering 706,020 acres, or 1,103
miles, and containing 503,616 inhabitants, Enteric Fever has for
past been unduly prevalent. Within this area, where the
e material is thus constantly ready to hand, there occur in
itary Districts, covering 117,404 acres, and containing a popula-
217,363, two marked and sudden outbursts of Enteric Fever,
large amount, the remaining area meanwhile exhibiting, as
its constituent sanitary districts, comparatively insignificant
" rates. One of the outbursts is at a time of year when, apart
me exceptional and unusual factor, Enteric Fever is not apt to
in epidemic form in this country. Within the sanitary districts
l by the two epidemic prevalences, some localities suffer heavily,
others escape exceptional incidence to the disease. One factor

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alone is found to be common to the places thus suffering exceptionally from Enteric Fever, and this is the use of water pumped from the river Tees. This river is found to be at all times subject to conditions of the grossest fouling by reason of the fact that human excreta and other filth are knowingly and deliberately conveyed to it. Opportunities for the access of the specific material of Enteric Fever to the river had been constantly recurring. And, immediately antecedent to the epidemic outbursts, sudden floods washed vast masses of the filth which had been accumulating on the banks of the river down the stream up to, and past, the points of intake from which the water was being pumped, and, after filtration through sand and gravel, delivered to certain populations. These populations it was who suffered from the two exceptional prevalences of Enteric Fever. Seldom, if ever, has a case of the fouling of water intended for human consumption, so gross or so persistently maintained, come within the cognizance of the Medical Department, and seldom, if ever, has the proof of the relation of the use of water so befouled to wholesale occurrence of Enteric Fever been more obvious and patent.

No. 7.

REPORT on an OUTBREAK of ENTERIC FEVER in the URBAN SANITARY DISTRICTS of ROTHERAM, RAWMARSH, and GREASBROUGH, in the WEST RIDING of YORKSHIRE; by DR. THEODORE THOMSON.

On the 11th of November, 1891, the Board received a communication om the Medical Officer of Health of the Rawmarsh Urban Sanitary istrict, near Rotherham, to the effect that an outbreak of enteric fever d occurred there. On the 20th of November the Medical Officer of ealth of Rotherham borough reported to the Board that an outbreak of teric fever had occurred in that district also. And on December 5th e Medical Officer of Health of the Greasbrough Urban Sanitary istrict, situated between Rotherham and Rawmarsh, similarly reported the Board an outbreak of enteric fever.

In accordance with instructions received from the Board, I proceeded investigate the circumstances attendant on the appearance in these stricts of epidemic enteric fever, and to this end made inquiries there December and on subsequent occasions.

The districts in question are grouped together in the south part of orkshire, in such wise that Rotherham and Rawmarsh nearly enfold reasbrough. Of the three, Rotherham is the most southerly.

ROTHERHAM URBAN SANITARY DISTRICT.

This borough has an area of 5,995 acres, and had, at the census of 91, a population of 42,050. A considerable portion of the district is rtly agricultural, partly woodland, and is sparsely populated, while e remainder is occupied by the town of Rotherham, situated on the iver Don. Both the town and the country parts of the district are lly. It is intersected not only by the Don and the Rother, the waters f which join just above the town of Rotherham, but also by numerous nall tributaries of these rivers. The chief industries in which the opulation is engaged are in connexion with brass working and the eel and iron trades.

The Public Drainage of the town of Rotherham consists, for the ost part, of good pipe or brick sewers, ventilated at intervals of bout 100 yards by vertical shafts terminating in gratings at the street vel. In two instances these shafts are carried into large chimney-acks. About 60*l.* per annum is spent in flushing and cleansing the ewers. Two main sewers have an insufficient gradient. The locality f Ickles, New York, Holmes, and Garrow Tree is not sewered, but rains partly into cesspools partly to the River Don. Private drainage effected, for the most part, by sanitary pipe drains, for which rain-ll pipes and soil-pipes serve as ventilating shafts. Old rubble drains, is stated, are rare. Almost all yard and sink-pipe gullies are trapped, nd sink pipes in the vast majority of instances are disconnected from e drains to which they discharge. All sewage conveyed by the main utfall sewers is discharged as such into the River Don.

Excrement Disposal and Removal.—The prevailing system in the orough is the privy midden, the pit of which is usually sunk two or ree feet below the ground level. These privy middens are often wet, nd frequently give rise to nuisance. They are scavenged by the nitary authority. There are also between 600 and 700 water-closets the borough.

Refuse Disposal and Removal.—House refuse is thrown into the rivy midden when this is the form of closet attached to the house; here, however, water-closets are in use, house refuse is disposed of in ovable receptacles, *or in brick ash-pits.* Its removal is undertaken by

the sanitary authority, who deposit what they cannot dispose of to neighbouring farmers on a tip near the River Don. A destructor, however, has recently been erected.

Water Supply.—Save in a few instances, where there are wells attached to houses, water is provided from the public supply belonging to the Corporation This supply is taken in part from two gathering grounds (the areas coloured respectively blue and pink to the right of the accompanying map), situated in the rural district east and south-east of Rotherham, and partly from three springs, two of which come to the surface in the rural district and one in the town itself.

Dwellings.—The bulk of the houses in Rotherham are working-class cottages, and are on the whole in fairly good condition, although, more especially in the older parts of the town, some are badly lighted, ill-ventilated, and damp. Some of the new cottages, owing to their being constructed of bad materials, are also damp.

Dairies and Cowsheds are registered, and have been put under regulation.

Slaughter-houses are also registered, but there are no byelaws for their regulation.

Infectious Disease.—Notification of certain infectious diseases, including enteric fever, has, under a local Act, been in force since 1879.

There is a hospital for infectious diseases, consisting of four wards and certain administration rooms. It is a wooden structure, containing 27 beds, with an average space of nearly 2,000 cubic feet per bed. With the exception of one case of scarlet fever, only small-pox patients have ever been removed to it.

Disinfection of dwellings after occurrence in them of infectious disease is effected by sulphur fumigation. Infected articles are subsequently washed by the householder. There is no steam disinfector, or other apparatus for disinfection by heat, belonging to the Corporation.

Rawmarsh Urban Sanitary District.

This Local Board District has an area of 2,549 acres, and had, at the census of 1891, a population of 11,893. It resembles Rotherham in consisting of a thinly-populated country portion and a thickly-populated part constituted by the small towns of Rawmarsh and Parkgate. The prevailing industries are coal-mining and the steel and iron trades. The inhabitants of the rural part are engaged in agricultural pursuits.

Public Drainage consists of properly constructed brick and pipe sewers, ventilated usually by shafts connected with street gratings, and occasionally by six-inch pipes carried above the eaves of houses. Except in a few instances, where it loses itself in ditches, all sewage is discharged as such into the River Don. Some years ago, "filter beds" were constructed for the purpose of treating the sewage, but these have been found to be a failure and are not now in use.

Private Drainage is effected for the most part by sanitary pipe drains; rainfall pipes are made to serve as ventilators, as also are the soil pipes of water-closets where these have been provided.

Excrement Disposal and Removal.—The prevailing system in the district is the privy midden, the pit of which is usually sunk two or three feet in the ground; the contents are frequently wet. Middens are scavenged by the sanitary authority. There are 87 water-closets in Rawmarsh and Parkgate.

Refuse Disposal and Removal.—House refuse is thrown into the privy midden where this form of closet exists. Where there are water-

closets, the refuse is collected in brick ash-pits, which are, in most instances, open to rainfall. House refuse is scavenged by the sanitary authority, who deposit this, and such privy contents as they cannot dispose of to farmers, at tips within the district.

Water Supply.—With the exception of one or two houses, which are provided with wells, water is supplied to the inhabitants of the town area comprised in Parkgate and Rawmarsh by the Rotherham Corporation, in consideration of an annual payment received by them from the Rawmarsh Local Board.

Dwellings.—The majority of the houses in the district are working-class cottages, generally of recent construction and in fair condition. Some, however, owing to their having been constructed of bad materials, are damp.

Dairies and Cowsheds are registered, and have been under regulation since August 1891.

Slaughter-houses are registered, but imperfectly controlled. There are no byelaws for slaughter-houses.

Infectious Disease.—Compulsory notification is not in force in the district; there has, however, existed "voluntary" notification of infectious diseases since the early part of 1887.

There is a hospital for infectious diseases, consisting of two buildings, one of brick, the other of wood, and giving a total of five wards with certain administrative rooms. The brick building, which is very damp, contains two wards, of which the cubic space is 5309 and 4909 feet respectively. The wooden structure contains three wards, two of which have each a capacity of over 7000 cubic feet; the third ward has a cubic space of 4725 feet. An old cab does duty as ambulance.

There is no disinfecting apparatus.

Greasbrough Urban Sanitary District.

This district has an area of 2270 acres, and at the census of 1891 had a population of 3217. Like Rotherham and Rawmarsh districts, it is partly rural in character, partly urban. The principal industries are coal-mining and the steel and iron trades. About one-tenth of the total population is engaged in agricultural pursuits. The inhabitants are collected mainly into two groups, one at Greasbrough village, another near Parkgate, with which a portion of Greasbrough district is continuous. This part of Greasbrough is termed Stone Row and Mangham Quarry, and differs from the rest of the district in some important particulars, to which reference will be made.

Public Drainage is effected by sanitary pipes. The sewage from Stone Row and Mangham Quarry is presumed to be filtered through beds of pebbles and sand before passing into the river; but these so-called "filter beds," when seen by me, showed no signs of sewage passing through them, and appeared to be quite useless. The sewage from Greasbrough village is passed on to a sewage farm, and there treated on the land.

Private Drainage is mainly by sanitary pipes, but there are still a few old rubble drains. The house drains at Stone Row and Mangham Quarry are formed of sanitary pipes. Air disconnection of the interiors of houses from drains is general throughout the district.

Excrement and Refuse Disposal and Removal.—The privy midden is the system in use throughout the district. The midden is usually sunk two or three feet below the ground level, and the contents are often wet. Save at Stone Row and Mangham Quarry, where scavenging is undertaken by the sanitary authority, the cleansing of privy middens is relegated to the occupier. In the case, however, of privy middens, the contents of which have accumulated so as to constitute a nuisance, the

sanitary authority now and again arrange for their cleansing by farmers in the neighbourhood.

Dwellings.—The houses at Stone Row and Mangham Quarry are mostly of comparatively recent date; but notwithstanding this, some are damp, and the cellars of not a few are liable to be flooded in wet weather. The same type of house is usual at Greasbrough village, where, however, there is in addition a small per-centage of old houses.

Water Supply.—Rotherham water is supplied to the Stone Row and Mangham Quarry portion of the district, and to the Greasbrough and the Carrhouse Collieries. Elsewhere wells are the sources of supply.

Dairies and Cowsheds are registered, but have not been put under regulation.

Infectious Diseases.—Up to the end of 1891 there was no system of notification of infectious disease. There is no hospital for the isolation of cases of infectious sickness, and no public disinfecting apparatus.

The Outbreak of Enteric Fever.

The epidemic of enteric fever, which has been the subject of inquiry, came under the notice of the several sanitary authorities concerned in the following ways. In Rotherham, where there is compulsory notification, sudden increase in the number of fever cases reported forced it on the attention of the sanitary authority. Similarly, in Rawmarsh, where a system of voluntary notification obtains, the existence of the epidemic became known by increase of notified cases. In Greasbrough, on the other hand, which is without notification of any sort, prevalence of fever would not have been known about but for the medical officer of health, who, on becoming cognisant of outbursts of the disease in Rotherham and Rawmarsh, set to work to ascertain by house-to-house inquiry whether or not his district was similarly affected. Table I. shows the number of *cases* that came under notice in the one or the other way in the three districts respectively during each of the months of 1891.

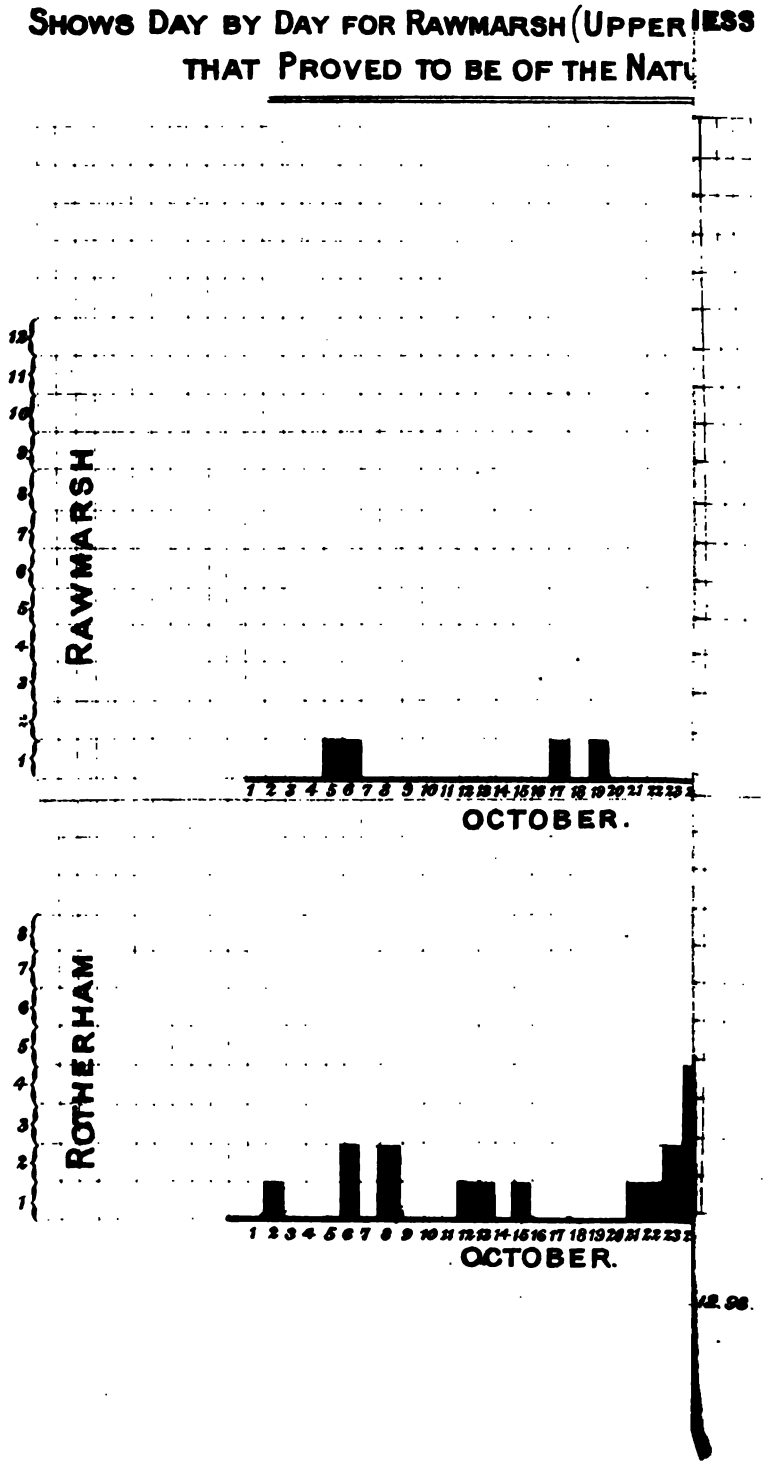
Table I.

Showing the Number of Cases of Enteric Fever coming to the knowledge of the Sanitary Authorities of Rotherham, Rawmarsh, and Greasbrough respectively, during each Month of the Year 1891.

1891. Month.	Rotherham.	Rawmarsh.	Greasbrough.
January	2	1	0
February	2	2	0
March	1	0	0
April	1	2	0
May	4	0	0
June	0	0	0
July	3	1	0
August	4	1	1
September	0	0	1
October	11	5	3
November	70	52	2
December	29	18	0
Total	127	77	7

The excess of cases in Rotherham over those given by the medical officer of health in his annual report is due to inclusion here of several that were verbally reported *by medical men* to the inspector of nuisances.

To face p. 49.


SHOWS DAY BY DAY FOR RAWMARSH (UPPER
THAT PROVED TO BE OF THE NATU
IESS
RAWMARSH
OCTOBER.
ROTHERHAM
OCTOBER.
12.98.

s regards *deaths* from enteric fever, the evidence is to the same , as is shown in the following Table II.:—

TABLE II.

wing the NUMBER of DEATHS referred to ENTERIC FEVER in each Month of the Year 1891 in the SANITARY DISTRICTS of ROTHERHAM, RAWMARSH, and GREASBROUGH respectively.

1891. Month.	Rotherham.	Rawmarsh.	Greasbrough.
ary - - - -	2	—	—
uary - - - -	1	—	—
h - - - - -	—	—	—
- - - - -	—	—	—
- - - - -	2	—	—
- - - - -	—	—	—
- - - - -	—	1	—
ust - - - -	—	—	—
mber - - - -	—	—	—
ber - - - -	2	1	—
mber - - - -	10	11	—
mber - - - -	9	2	—
Total - - -	26	15	—

he above were the facts presented to me at an early stage of my uiry. But I judged it necessary for my purposes to seek more ticular information respecting the facts as to the fever during the nths of its chief prevalence. Accordingly, by help of the several dical men practising in the district, I not only obtained information the last five months of the year of a number of fever cases that had , owing to their transient character or to their failure to evince inite symptoms of enteric complication, been reported, but obtained o information of the date of attack in each instance of fever, ether enteric or of a less definite sort.* In this way—though some r cases may have been included that were not fever at all—the ensions of the epidemic in the several districts became better under- d, and, especially, the incidence in time of the fever was made able of more accurate expression. Table III. and the accompanying rt (I.) exhibit the fever outbreak from this point of view.

TABLE III.

wing the NUMBER of CASES of ILLNESS of the NATURE of "FEVER" ascertained to have occurred in the ROTHERHAM, RAWMARSH, and GREASBROUGH SANITARY DISTRICTS during each of the last Five Months of 1891.

1891. Month.	Rotherham (population 42,050.)	Rawmarsh (population 11,983.)	Greasbrough (population 3,219.)
August - -	4	—	1
September - -	2	1	1
October - -	37	14	3
November - -	74	78	2
December - -	28	8	—
Total - -	145	101	7

In view of the above facts, I refer, in certain tables and in the charts accompanying this report, to the cases of sickness of which I got information under the "fever"; preferring this term, under the circumstances, to "continued" or to "enteric" fever.

Both table and chart go to show, better than previous data, simultaneous as well as sudden outburst of fever in Rotherham and Rawmarsh. As regards Greasbrough, the facts as they stand are too few to justify any inference as to time relations of fever here with fever in the other districts; but, as will presently be seen, the scanty amount of fever in Greasbrough may not be without a significance of its own.

In seeking an explanation of the above outburst, at one and the same time, of fever in Rotherham and Rawmarsh, and of simultaneous though minor prevalence of the disease in Greasbrough, a circumstance, already incidentally referred to in the description of these places, at once forced itself into notice. This was that all three places obtained one and the same water-supply. In view, indeed, of what we know of the ability exhibited elsewhere by water supplies for wholesale dissemination of enteric fever, this circumstance could not but be regarded as of perhaps essential importance; as being a condition for instance that, *in the absence of satisfactory explanation of the epidemic in some other way or ways*, was to be thought of as affording presumption that the Rotherham water-supply had been in fault, and as demanding therefore examination of the sources of that supply, for the purpose of determining whether or not the Rotherham water was open to that sort of fouling which has elsewhere been productive of enteric fever through the medium of the public water service.

Causes of the Fever Outbreak other than Water Supply.

With reference to possible causes other than water-supply, of the total fever witnessed—causes, for example, that might have operated separately, though simultaneously, in the several localities under consideration,—drainage and sewerage arrangements, excrement disposal, and milk supply, each in their possible relation to the fever, were passed in review. And with result as follows:—

Drainage and Sewerage Arrangements.—Each of three districts of Rotherham, Rawmarsh, and Greasbrough, has a separate system of sewers. There is, at no point, any connexion between the sewers of one district and those of another. In all these districts sewers and drains are, for the most part, well constructed. Occasional exceptions only were to be found, where the gradient or structure of sewers was unsatisfactory. Neither in Rotherham nor in Rawmarsh, nor in Greasbrough, however, did I find that any line of sewers had been marked by exceptional occurrence of fever cases along its course. Air disconnection of the interiors of houses from drains is general throughout all three districts, and almost every household invaded by "fever" had in this way been already protected against ingress of sewer air.

These facts suffice to indicate that the cause of the outbreak of enteric fever is not to be found in connexion with drainage and sewerage arrangements of the affected districts.

Excrement Disposal.—In Rotherham about 90 per cent. of the total houses are served by privy middens, and about 10 per cent. are furnished with water-closets, while in Rawmarsh these figures are 94 per cent. and 6 per cent. respectively. On an assumption, therefore, that privies had had to do with the fever, considerably more in Rotherham than 90 per cent., and considerably more in Rawmarsh than 94 per cent., of the total invaded houses should have been found to be served by privies. Similarly, if water-closets had been at fault, in Rotherham more than 10 per cent., and in Rawmarsh more than 6 per cent., should have been found to be furnished with water-closets. As

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a matter of fact, however, it turned out that of the total houses invaded—

In Rotherham 89 per cent. had privies, and 11 per cent. water-closets;

In Rawmarsh 95 per cent. had privies, and 5 per cent. water-closets. There was, therefore, no special incidence of the disease on either the houses having privies, or in the houses having water-closets. Rather, it is suggested by these figures that the chief cause of the outbreak was some agency operating in entire independence of methods of excrement disposal.

Milk Supply.—In Rotherham the milk supplied to families in which enteric fever had appeared was derived from 45 different sources, and the largest number of cases occurring among the customers of any single milk-vendor was five. This maximum number occurred in three instances. The number of total customers supplied by these three vendors was respectively 66, 110, and 88. In Rawmarsh the milk supplied to invaded households was derived from 15 different sources. The largest number of cases occurring among the customers of any single vendor was 15. Another vendor had 12 cases among his customers, two others had each six, and two had five a piece. The annexed short tabular statement shows the proportion of cases among the total customers supplied by each of these six milk vendors in Rawmarsh.

Cases.	Customers.
15	444
12	261
6	99
6	81
5	31
5	115

The households invaded in the Greasbrough district all received their milk-supply from different sources.

The multiple sources of the milk supplied to the invaded houses, and the absence among these milk supplies of any one showing a relatively large proportion of attacks among its customers, are facts discounting altogether the hypothesis that in the milk-supply is to be found the cause of the outbreak of enteric fever in Rotherham, Rawmarsh, and Greasbrough.

Water Supply as a Cause of the Outbreak.

Recurring now to the Rotherham water-supply that was common to all three districts, and against which presumption arises in the absence of other ready explanation of the epidemic, certain general considerations, some of them favouring, some of them perhaps adverse to such presumption, have to be referred to before passing to examination, with a view to detecting opportunities for pollution, of the sources of the water service in question.

But first there is need for more detailed description than has yet been given of the Rotherham waterworks, with differentiation of one from another service.

The sources of the water-supply common to Rotherham, Rawmarsh, and part of Greasbrough are of a somewhat complicated description. Comprehension of these will be facilitated by reference to the accom-

panying map. They consist of two main sections, kn as the Dalton, or low level, and the Ulley, or high le being derived from their respective gathering grounds and from the level of their distribution areas on the othe

The Dalton, or "low-level" supply, is derived in part grounds of that name, in part from a spring terme spring. The water from the gathering grounds is no reservoir, but is filtered through beds of sand and gra passes by iron pipes to the Aldwarke pumping station, b the way by the Aldwarke spring water. The latter water From the Aldwarke pumping station these two waters are the Cranworth Road Reservoir, from which the low-le supplied by gravitation.

The Ulley, or "high-level" supply, is derived partly fr grounds of that name, partly from two springs. The wa from the gathering grounds is accumulated in a reservoir si junction of the two valleys which constitute these gather On leaving this reservoir it is passed through sand and gra and is then carried in iron pipes to the central pumpin Rotherham. At Woodfoot, on its way from the filter to R is joined by water from the Pinch Mill spring, and the combi thus formed, is further joined in College Yard, Rotherham, b of the Wellgate spring. These three waters, thus united, a from the central pumping station to the Boston and t reservoirs, from which the high level area is supplied by gravi

There are, therefore, at Rotherham two entirely separate di water-supply, derived each from its own particular gatherin and springs, and which have, accordingly, no community of ori

These two supplies are likewise distinct in distribution.

The Dalton water, termed the "low level," is, as will be reference to the map, supplied to a portion of Rotherham estimated to have had in 1891 a population of 22,000, and Greasbrough Urban Sanitary District—to Carrhouse Colliery* (en about 1,000), and to 10 houses belonging thereto (population 76

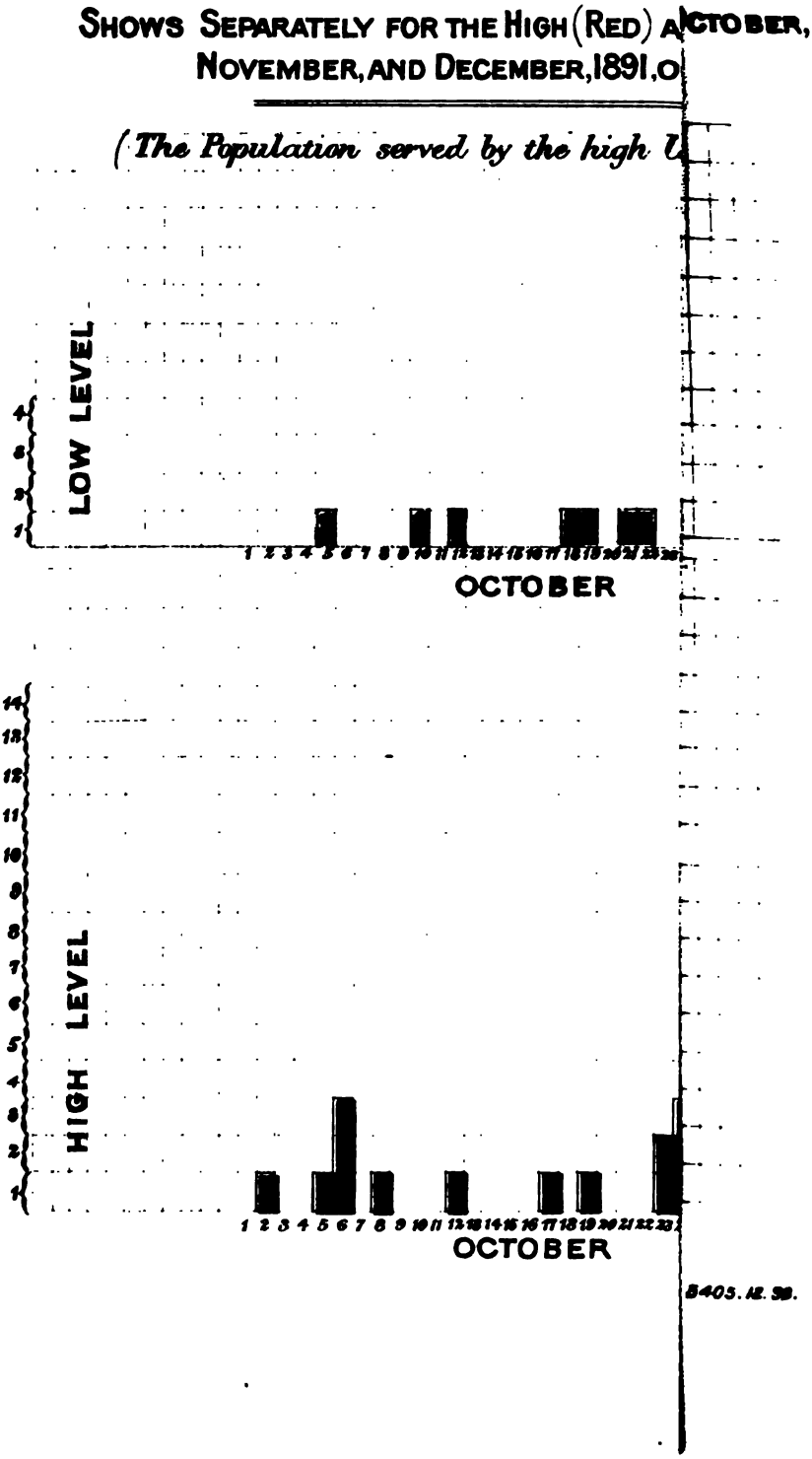
The Ulley water, termed "high level," has a more complicate distribution areas, which, for clearness, are here appended tabular form.

"High Level" Water distribution Areas.	Es Pop
Part of Rotherham - - - - - - - -	2
Rawmarsh - - - - - - - -	1
Stone Row and Mangham (Greasbrough U. S. D.) - - -	
Greasbrough Colliery and two houses (do.) - - -	
Hesley Lane (Wortley R. S. D.) - - - - -	
Part of Wentworth, Part of Whiston - } Rotherham, R.S.D. - - - -	{

The separate distribution, however, of the two divisions of the ham Corporation water-supply is not invariable, inasmuch as w

* The colliery people reside in Rotherham, Rawmarsh, Greasbro Kimberworth. While at work they seldom drink water, but rather co home-brewed beer.

To face p. 53


SHOWS SEPARATELY FOR THE HIGH (RED) A
OCTOBER,
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(The Population served by the high l
LOW LEVEL
OCTOBER
HIGH LEVEL
OCTOBER
B405. 12. 89.

pumping station of the one service is under repair water from the other service is substituted, and also because in the case of a fire breaking out in the low-level area, it is usual to turn the high level water into the low level mains for the purpose of obtaining greater pressure. Nevertheless, in the circumstance that the sources of origin and, but for occasional exceptions, the areas of distribution also of the two sections of the Rotherham water-supply were, in the main, distinct one from the other, further light might, it was thought, be obtained on the problem as to whether the recent dissemination of enteric fever took place through water. For if water-supply had been the agent in question, it appeared altogether unlikely, in view of their separate origin, that both sections should simultaneously have been capable, each in its own area of distribution, of wholesale dissemination of fever. And accordingly, with a view to ascertain a different ability (if any) of the two sections of water supply to cause fever, examination was made of the extent to which the recent fever had affected the high- and low-level areas of service respectively. In the following Table (IV.) and in the accompanying Chart (II.) is shown the contrast between these areas in this respect, constituting the—

Primâ facie Case against the Rotherham Water.

TABLE IV.

Showing the NUMBER of "FEVER" ATTACKS, REPORTED and UNREPORTED, occurring during the last three months of 1891, among PERSONS resident in the HIGH- and LOW-LEVEL AREAS of the ROTHERHAM WATER SERVICE; with the Proportion of such Cases to the Total Population of each of the Areas in question.

Distribution Area.	Estimated Population.	Reported Cases.	Non-reported Cases.	Total Cases.	Rate of attack.
High level - -	34,000	163	48	211	1 in 161.
Low level - -	23,000	22	11	33	1 in 697.

This table, based on the number of persons attacked by fever during the months of October, November, and December, 1891, shows that there was a very great difference in incidence of the disease on the high- and the low-level areas. Of persons living in the former, one out of every 161 was attacked by fever, whereas of persons living in the latter, only one out of every 697 was similarly affected. The Chart (II.) shows still more strikingly the same facts. Pointing also in the same direction as these general data is the distribution of fever in the Greasbrough Urban Sanitary District, wherein no case occurred save in that portion known as Stone Row and Mangham Quarry. Here, however, there were seven cases. The population of this part of Greasbrough, numbering in all some 500, are supplied solely with the Rotherham high-level water, while in the rest of the district the water-supply is mainly from wells. Thus the only enteric fever known to have occurred in Greasbrough in 1891 appeared in that part which is supplied with Rotherham high level water.

These data then tend to favour the hypothesis that the fever-producing agent has been the Rotherham water, and to indicate that the particular section responsible for this condition has been the high-level supply.

But, on the other hand, there are certain facts which do not appear to be entirely in harmony with this theory, and these I now proceed to consider.

App. A. No. 7.

n an Outbreak Enteric Fever Rotherham, awmarsh, and reasbrough; r Dr. Theodore homson.

The Case against Water in its Negative Aspects.

1. In the first place, certain areas received the Rotherham high-level water, and yet no case of enteric fever is known to have occurred in them during the autumn of 1891. These are as follows:—

Hesley Lane, with a population of about 600.

Part of Wentworth, with a population of about 150.

Part of Whiston, with a population of about 60.

Greasbrough Colliery, plus two houses, with a population of about 160.

2. In the second place the low-level area in Rotherham, although less severely affected than the high, did not entirely escape fever.

3. In the third place Rawmarsh appeared to have suffered, in proportion to its population, in excess of high-level Rotherham.

The following table, Table V., based on the number of persons attacked in the months of October, November, and December 1891, illustrates the latter two points:—

TABLE V.

Showing the NUMBER of "FEVER" ATTACKS occurring during the last three months of 1891 among PERSONS RESIDENT in the ROTHERHAM "LOW-LEVEL AREA," the ROTHERHAM "HIGH-LEVEL AREA," and in RAWMARSH; with the PROPORTION in each instance of ATTACKS to POPULATION in the AREAS in question.

Distribution Area.	Population.	Cases reported.	Cases not reported.	Total Cases.	Rate of Attack.
Rotherham low level -	22,000	22	11	33	1 in 666
Rotherham high level	21,000	88	17	105	1 in 200
Rawmarsh (high level)	12,000	70	31	101	1 in 119

With regard to objection No. 1, it may be pointed out, as tending to lessen its exculpatory value, that in every instance referred to the populations supplied with the high-level water are small. The expected amount indeed of fever, on the basis of that actually witnessed in the Rotherham high-level area, for Hesley Lane, Wentworth, Whiston, and Greasbrough Colliery would not exceed some half-dozen cases; and a small population might very well for a limited time escape infection, although supplied with a water which was spreading disease elsewhere, provided the infective material was present in the water in intermittent fashion only. The larger the population supplied with such water, and the longer the period this water remains infective, the greater is the chance of fulfilment of all the conditions necessary for the reception and propagation in a number of persons of the enteric infection, and for subsequent recognition of the disease produced.

With regard to objection No. 2, viz., that "low-level" Rotherham did not entirely escape fever, it has to be remarked that the prevalence of enteric fever there was hardly in excess of what is customary in many towns in the autumn season. What excess there was, is lessened by the deduction of seven cases, of whom three were in service in the high-level district up to the date of attack, when they went to their homes in the low-level district. Other four of the seven were persons who spent the day at work in the high-level district, and were thus liable to have contracted infection by drinking high-level water. Furthermore, on November 12th, on account of a fire in the low-level district, the high-level water was turned into the low-level mains, a fact

which might possibly be cited as accounting for a subsequent slight increase of cases in the low-level area, which will be observed on reference to Chart II.

With regard to objection No. 3, viz., the somewhat greater amount, in proportion to its population, of enteric fever in Rawmarsh, I could not find any material difference in the sexes and ages of the sufferers in the two places. Nor did I hear of a larger proportion of "abstainers" in Rawmarsh than in Rotherham. And I was led to consider whether in Rawmarsh possibly fewer cases than in Rotherham had escaped the cognizance of the Sanitary Authority. It is conceivable, for instance, that in Rawmarsh, among a population of 12,000 persons, medically attended by three practitioners, all living near to and in frequent communication with each other, and one of whom is the Medical Officer of Health, few cases would fail to come to the knowledge of this official; whereas in the larger district of Rotherham, owing to the less degree of personal communication with his medical brethren, the Medical Officer of Health might not become cognisant of cases of a slighter character. Indeed the greater fatality of the disease in Rotherham points in this direction.

Such, then, are the facts tending to hesitation in accepting water causation of the recent fever outbreak in these districts. These, though not inconsistent with such causation of the fever, do beyond doubt discourage any conclusion to that effect on the evidence so far adduced; and it was upon this view that I, at the stage of my investigation now reached, sought to ascertain what had been the relations of fever and water service in Rotherham in previous years. For, if the Rotherham high-level water had been in 1891 the chief agent in the outbreak of enteric fever, it appeared not improbable that in antecedent years it might have played a similar part. Before going into this matter, however, I give for the better appreciation of the facts I am about to submit, a brief history of the Rotherham and Rawmarsh water-supplies.

Relations of Rotherham Water-Supply and Enteric Fever in previous years.

For many years prior to 1864, Rotherham derived its principal water-supply from the Wellgate spring. In 1864 an additional supply was obtained from the Pinch Mill spring and from the Ulley gathering grounds, and, finally, in December 1884, the waters of the Aldwarke spring and of the Dalton gathering grounds were added to the supply. All these waters were, until the end of September 1887, mixed and distributed throughout the district. But in that month high and low level distribution areas were formed, the waters from Ulley, Pinch Mill, and Wellgate being distributed to the former, and those from Aldwarke and Dalton to the latter. This arrangement has since continued, broken only at rare intervals, and for short periods, by such incidents as failure or repair of the pumping apparatus for either level, or the occurrence of a fire in the low-level area, which latter occasionally necessitates the filling of low-level mains with high-level water, for the sake of obtaining sufficient pressure.

Rawmarsh, until 1869, derived its supply from local wells. In that year the Rawmarsh Local Board entered into an agreement with the Rotherham Local Board "to take water" from the latter "at all times "for ever, as Rotherham might be able to supply." Thenceforward to the end of September 1887 the supplies of these two districts were one and the same. But after that date, while the one half of Rotherham became supplied with low-level water and the other half with high-level water, the Rawmarsh district was supplied with high-level water only.

Tables VI. and VII. show the number of deaths from enteric fever that have occurred in Rotherham and Rawmarsh since 1881, with the rates in each instance per 1,000 population. And in Table VIII. these rates are compared with the rates from the same cause in the whole country, and in the 28 large towns. It should, however, be borne in mind, while comparing the Rotherham and Rawmarsh figures with those of the 28 large towns, that the "fever" rate of the latter is based on deaths caused, not merely by enteric, but also by typhus and "continued" fevers, and that, accordingly, the death-rate in these large towns from enteric fever *alone* would be lower than the "fever" rate quoted.

TABLE VI.

Showing the NUMBER of DEATHS referred to ENTERIC FEVER, with the ESTIMATED RATE of MORTALITY from this CAUSE, in ROTHERHAM during each of the Ten Years 1882–91.

Year.	Population.	Enteric Fever.	
		No. of Deaths.	Death-rate per 1,000.
1882	35,617	7	0·20
1883	36,299	15	0·41
1884	36,995	18	0·49
1885	37,703	12	0·32
1886	38,426	32	0·83
1887	39,162	11	0·28
1888	39,912	8	0·20
1889	40,677	4	0·10
1890	41,456	7	0·17
1891	42,250	26	0·64

The estimated populations are based on calculations made from 1881 and 1891 census figures, and are given for the middle of each year.

TABLE VII.

Showing the NUMBER of DEATHS referred to ENTERIC FEVER, with the ESTIMATED RATE of MORTALITY from this CAUSE, in RAWMARSH during each of the Ten Years 1882–91.

Year.	Population.	Enteric Fever.	
		No. of Deaths.	Death-rate per 1,000.
1882	10,070	4	0·40
1883	10,272	6	0·58
1884	10,478	1	0·09
1885	10,689	5	0·47
1886	10,903	8	0·73
1887	11,122	6	0·54
1888	11,346	4	0·35
1889	11,573	2	0·17
1890	11,806	1	0·08
1891	12,043	15	1·24

The Rawmarsh populations are estimated as in case of Rotherham. They do not comprise Kilnhurst (population probably under 500), which, from 1881 to 1885 inclusive, formed part of the Rawmarsh Urban Sanitary District.

Table VIII.

Showing the Enteric Death-rate in Rotherham, in Rawmarsh, in 28 Large Towns, and in England and Wales, in each of the Ten Years 1882–91, and in Separate Divisions of this Period.

Year.	Death-rate per 1,000 population in each instance.			
	Enteric Fever. Rotherham.	Enteric Fever. Rawmarsh.	"Fever." 28 large Towns.	Enteric Fever. England and Wales.
1882	0·20	0·40	0·37	0·23
1883	0·41	0·58	0·35	0·23
1884	0·49	0·09	0·29	0·24
1885	0·32	0·47	0·20	0·17
1886	0·83	0·73	0·23	0·18
1887	0·28	0·54	0·22	0·18
Mean of 1882–87	0·42	0·47	0·28	0·20
1888	0·20	0·35	0·23	0·17
1889	0·10	0·17	0·20	0·18
1890	0·17	0·08	0·19	0.18
1891	0·64	1·24	0·20	—*
Mean of 1888–91	0·28	0·46	0·20	

* Figures not yet published.

A comparison of the enteric death-rates in these tables shows that in both Rotherham and Rawmarsh these have attained a decidedly higher average, during the ten years 1882–91, than in the 28 large towns; and that not only has the average rate in Rotherham and Rawmarsh during these years been above the normal, but that there have been several years when, judging by the enteric death-rate, that disease has appeared in epidemic form in both places. Also it is to be observed that in 1883, 1886, and 1891, marked rises in the enteric death-rate in the one district have been coincident with similar rises in the other.

Further consideration of these figures shows that whereas during the six years, 1882–7, the average enteric death-rate was 0·42 per thousand living in Rotherham, and 0·47 per thousand living in Rawmarsh, during the next following four years, 1888–91, the Rotherham rate fell to an average of 0·28 per thousand living, while the Rawmarsh rate was 0·46 per thousand living; that is to say, practically remained as before. Now it was in September 1887 that the Rotherham water-supply became differentiated into two services, one high level, and the other low level. If, therefore, in years antecedent to 1891 the present high-level supply was an occasional cause of enteric fever; then, prior to September 1887, the whole population of Rotherham was consuming a dangerous water; for before December 1884 there was no other than the high-level supply, and, between December 1884 and September 1887, the high-level and the newly provided low-level supplies were mixed. But, as has been said, after September 1887 more than half of the population of Rotherham received, with occasional exceptions, low-level water alone. Accordingly, if the latter has been less productive of enteric fever than the high-level water, it was to be expected that the enteric death-rate of

Rotherham as a whole would fall after 1887:—And this is precisely what happened. Rawmarsh, on the other hand, though supplied prior to September 1887 with the same water as the whole of Rotherham, has since that date received, with occasional temporary exceptions, high-level water only. Accordingly, as regards Rawmarsh, if the high-level water has throughout been more or less in fault, the enteric death-rate therein should not have declined after 1887 as it has done in Rotherham. Nor has it declined; it has, the table shows, remained practically unchanged.

There can be no doubt, therefore, that in former years, as in 1891, persons consuming water from the high-level source of supply, have been, wherever they resided, more prone to enteric fever than persons not using that water. The presumption, therefore, becomes a strong one that the Rotherham high-level service has for a number of years been an important factor of fever among populations supplied thereby; and this presumption is considerably strengthened by other facts which illustrate the same point, and which are given in the following table (Table IX.). This table shows the number of *cases* of enteric fever in Rotherham that have since 1882 been notified to the sanitary authority. I have divided these cases into two lists, according as they resided in the high-level or the low-level district. Prior to September 1887, there was, of course, no such distinction, and it is to be understood that the cases attributed to each area prior to that date occurred in the areas as now constituted.

TABLE IX.

Showing for the existing "HIGH-LEVEL" and "LOW-LEVEL" AREAS respectively of ROTHERHAM BOROUGH the NUMBER of CASES of ENTERIC FEVER notified to the SANITARY AUTHORITY in each of the 10 years 1882–91.

Year.	High-Level and Low-Level Areas getting as Water Supply	High-Level Area.	Low-Level Area.	Hospital and Work-house.	Total.
1882	High level water alone	28	36	8	72
1883		36	40	5	81
1884		52	78	4	134
1885	Mixed high level and low level water.	24	28	7	59
1886		82	117	9	208
1887		21	40	1	62
1888	High level and low level area getting each its separate water supply.	23	17	—	40
1889		18	15	—	33
1890		22	18	—	40
1891		91	36	—	127

The cases occurring in the hospital and workhouse during the years 1882-87 could not be distributed to the area in which they occurred.

The population of the low-level district was somewhat larger relatively to the high level population in the earlier part of the period taken.

This table brings out clearly the fact that up to and inclusive of 1887, while both areas were alike getting more or less high-level water, the preponderance of cases always occurred in the low-level area. This was to have been expected, because the low-level area, even now somewhat more populous than the high-level area, was at that time decidedly more

so. But subsequent to 1887 we find that, notwithstanding its smaller population, the high-level area shows the majority of cases.

The year 1887 itself merits special consideration. It was at a particular period in this year that the high-level and the low-level areas became, for the first time, separately supplied; and accordingly, seeing that enteric fever is usually most prevalent in this country in late autumn, it was to be expected—on a hypothesis of superior ability to cause fever possessed by the high-level water—that in 1887 a comparatively larger incidence of the fever on the high-level area would be for the first time manifested. But nothing of the sort occurred. As in former years, so in 1887, the low-level area continued to suffer largely in excess of the high-level area, and, until the data of 1887 are more closely examined (Table X.), the reason of this seeming variance of fact from hypothesis is not understood.

TABLE X.

Showing for the "HIGH-LEVEL" and "LOW-LEVEL" AREAS respectively of ROTHERHAM BOROUGH the NUMBER of CASES of ENTERIC FEVER notified to the SANITARY AUTHORITY in each of the several Months of 1887.

1887.	High- and Low-Level Areas getting as Water Supply	High-Level Area.	Low-Level Area.
January	Mixed high- and low-level water.	3	12
February		2	5
March		1	8
April		1	1
May		1	—
June		1	2
July		2	1
August		2	3
September		6	5
October	High- and low-level area getting each its separate supply.	2	2
November		—	1
December		—	—

It is here seen that of the total enteric fever cases in Rotherham in 1887 more than 90 per cent. occurred before the water services were rendered separate; occurred, that is, while the high-level and the low-level areas were still alike supplied with mixed high-level and low-level water. Practically there was in 1887 no fever in Rotherham after September, and accordingly a different incidence of the fever on the high-level area, as compared with the low-level area, as a result of limitation to the former of high-level water, which previously went to both areas, must needs be looked for not in 1887 but in 1888; and, as a matter of fact, in 1888 comparatively greater incidence on the high-level area is for the first time manifested, as will be seen by reference to Table IX.

Having regard, therefore, to years antecedent to 1891, whether fever *attacks* in Rotherham are separately considered, or whether fever *deaths alone* in Rotherham and Rawmarsh be appealed to, the evidence is unmistakeably to the same effect:—Namely, that the autumn of 1891 was not the first occasion on which habitual use of Rotherham high-level water has been associated with exceptional prevalence of enteric fever among populations consuming it.

Actual circumstances in 1891 *of the Sources of the Rotherham Water-Supply with reference to risk of dangerous Pollution.*

In view of all the above facts, and of inferences thence arising, the question that now requires consideration is:—Whether or not the sources of the Rotherham water-supply have been, and are, liable to risk of dangerous pollution. Bearing on this point I have, through personal inspection, and by other means, collected facts which I now proceed to state in detail.

The Low Level Sources.—The Dalton gathering grounds comprise about 1,200 acres of land, of which the smaller part is woodland or uncultivated, while the remainder is chiefly pasture, with, however, a not inconsiderable amount of arable land. Both pasture and arable lands require and receive regular manuring; the manure used at times including, as I am informed by an eye witness, night soil. The gathering grounds consist of two convergent valleys, one of which is, with two exceptions, free from human habitation. The two exceptions consist of two houses and farmyards, from one of which farmyard-sewage washes into the stream about to contribute to the water-supply; while, from the other, house and farmyard alike send sewage to pollute the stream. As to the other valley, on the sides of it are situate the villages of Dalton Magna and Dalton Parva. Of the former the greater part of the house drainage and of farmyard-sewage passes into and pollutes the water-supply; of the latter, all the sewage, save from three houses, passes into the stream below the point at which a supply is taken for Rotherham. The water taken from the main stream, formed by the junction of the two brooks that flow down the valleys in question, is, as already described, filtered and conveyed to the Aldwarke pumping station. The Dalton filter beds are three in number, with a total area of 974 square yards. The Aldwarke spring, which joins the Dalton water at the pumping station, issues at the foot of a low hill of cultivated land near a public road. Its water is unfiltered.

The following table shows the amount of water estimated as supplied to the low level area during September, October, and November 1891, and how the supply is constituted:—

Rotherham Low Level Water Supply.	September.	October.	November.
	Gallons.	Gallons.	Gallons.
From Dalton gathering grounds -	306,804	340,807	349,928
„ Aldwarke Spring - -	76,647	83,566	83,566
Total - - -	383,451	424,373	433,494

The High-level Sources.—The Ulley gathering grounds comprise an area of about 2,200 acres, and like the Dalton are formed by two convergent valleys. Only a small proportion of the land constituting these gathering grounds is uncultivated. It mostly consists, in tolerably equal parts, of pasture and arable land, much of which, down to the very margin of the streams threading their way to the reservoir, was at the time of my visit covered with manure. This manure consisted, in at least one instance that I observed, of nightsoil and ashes. Several villages are situated within the gathering ground. Two of these, however, viz., Morthen and Brampton, do not appear to directly

pollute the water supply, inasmuch as Morthen is drained into cesspools, and, except for one house, Brampton drains out of the Ulley watershed. Other villages, however, viz., Ulley, Aughton, Aston, and Aston Netherthorpe, are obvious and serious causes of pollution to the water taken from these gathering grounds. The drainage of the village of Ulley, with the exception of what is lost in the ground surrounding the village, passes directly into a stream which flows down to the reservoir. This drainage consists of liquid refuse from house-yards, farmyards, and sinks. In Aughton and Aston, house drainage has, by means of intercepting sewers, been conveyed out of the watershed, but yard drainage is still allowed to flow down fields constituting part of the gathering ground. This yard drainage consists not merely of rain-water, and yard washings; it is contaminated by farm-yard refuse, and by part of the house-slops, which are frequently thrown down the yard gratings. The Aughton yard drainage is conveyed by pipes to a neighbouring pond of small size situated at a level above that of the reservoir. The overflow from this pond, however, descends by an open channel towards the head of the reservoir, and notwithstanding that carriers have been placed along the course of this channel for the purpose of irrigating a field between the village and the bottom of the valley, I found, on the two occasions when I visited the spot, that the channel in question was discharging directly into the reservoir head. The Aston yard drainage is, for the most part, conveyed into cesspools which are emptied on the surrounding land which constitutes part of the gathering ground. The Aston Netherthorpe house and yard sewage is conveyed by pipes into a tank situated in a field sloping towards a pond through which a rapid stream flows down the valley to the reservoir. From this tank the sewage is conveyed in an open carrier, running parallel (at 50 yards distance) with the edge of the pond, and is distributed over the ground between the carrier and the pond.

The Ulley reservoir is on two sides protected by by-washes from the danger of immediate contamination by drainage from adjacent cultivated land. These by-washes, however, are not watertight, but permit leakage into the reservoir. On the third side the reservoir has no protecting by-wash, and the surface water from cultivated land on that side can pass directly into it. In time of flood the two streams feeding the reservoir can be excluded by flood-gates, which are, it is stated, closed when heavy rains bring down turbid water to an extent which may be considered by the official in charge to indicate the desirability of taking this step. Owing, however, to the leaks in the by-washes such turbid water can, notwithstanding this, finds its way into the reservoir.

The Ulley filter beds are three in number, and have a total area of 1,221 square yards. Two constructed in 1864 were last thoroughly cleansed in 1885; the third, which had not been cleansed throughout since it was laid down in December 1881, was opened for my inspection, when it was found that the lower 6 inches of the superficial layer of fine sand were in a very dirty condition.

The Pinch Mill spring, the water from which has been already described as joining that from the Ulley reservoir, issues at the foot of a hill which is in pasture.

The only other important contributor to the high level water is the Wellgate spring, which issues under the Wellgate, a street situated in the centre of the borough of Rotherham.

I append a table which shows the amount estimated as contributed from each source to the Ulley (high level) supply during September, October, and November 1891.

Rotherham High Level Water Supply.	September.	October.	November.
	Gallons.	Gallons.	Gallons.
From Ulley gathering grounds -	309,224	279,276	284,500
„ Pinch Mill Spring - -	199,210	199,210	144,297
„ Wellgate Spring - -	137,076	137,076	137,076
Total - - -	636,510	615,562	565,873

The foregoing account of the condition of the gathering grounds renders it abundantly clear that the water of both the high and the low-level services has been, and remains, open to grave risk of pollution. Both gathering grounds contain a great deal of cultivated land which is manured not only with farmyard but also with privy midden refuse. And sewage from villages, as well as from detached houses, finds its way into the water supply, more especially on the Ulley (high level) gathering grounds. Further, one cannot but regard with the utmost distrust a supplemental source of supply such as the Wellgate spring, which issues in the centre of a town of over 40,000 inhabitants.

If corroboration be wanted of the doubtful quality of Rotherham water indicated by the facts of my survey of its sources, corroboration is to hand in reports by the county analyst for the West Riding on samples of this water supply submitted to him by the Rotherham Sanitary Authority. Again and again this analyst has shown the water drawn from taps in Rotherham to contain excess of chloride and nitrates and too large a proportion of free and albuminoid ammonia, with high figures also under the head of "oxygen required." And he has reported to similar effect on water samples taken from brooks in the gathering grounds, and from the Aldwarke and the Pinch Mill springs. As regards the Wellgate spring, his analyses are of a still more compromising nature. I have had submitted to me five certificates of analysis of this water, one made in 1886, three in 1890, and one in 1892. In every one of them is there indication of serious and similar contamination of a sort which the analyst considers, in at least one instance, to point to "pollution by urine, cesspool drainage, or similar impurity."

Appended to this report are copies of certificates of analysis of high-level tap water, low-level tap water, and of water from each of the three springs—Pinch Mill, Aldwarke, and Wellgate. So far as tap water and Wellgate water are concerned, the certificates selected are not, as regards either, those showing the least satisfactory results. A single sample only, in each instance, of the Pinch Mill and of the Aldwarke waters appears to have been analysed.

Summary.

The facts obtained by me, and embodied in this report, afford strong indication that the outbreak of enteric fever in the Rotherham, Rawmarsh, and Greasbrough districts in the autumn of 1891, was due,—not to defects connected with sewerage, drainage, or excrement disposal; not to a contaminated milk supply:—But to the public water service of these districts, especially to one particular section of it, viz., that known as the high level supply. And further, there is like indication that on previous occasions this same section of the Rotherham water supply has been similarly detrimental to the health and lives of the inhabitants of Rotherham and Rawmarsh. These facts, combined with the data furnished regarding the several sources of the Rotherham water, deserve the serious consideration of the Town Council in connexion with the question of the water-supply of the districts reported on.

ADDENDA.

(A.)

ALDWARKE SPRING.

No. 1, Surrey Street, Sheffield,
November 12th, 1886.

REPORT on a SAMPLE of DRINKING WATER, received from the CORPORATION of the BOROUGH of ROTHERHAM, on October 26th, 1886. Sample Mark, "No. 28."

Physical characters:—
The sample contained no suspended matter.
Appearance of a column two feet in length, clear and colourless.
Taste, normal.
Smell, none.

On analysis, the sample gave the following results:—

Total solid matter	22·68	grains per gallon.
Non-volatile matter	17·08	„ „
Loss on ignition	5·60	„ „
Chlorine	2·25	„ „

(*Equivalent to chloride of sodium*, 3·71 *grains.*)

Nitrogen, existing as nitrates and nitrites, moderate.
Lead and other poisonous metals, none.

The sample had a hardness of 15·5 degrees. (*Each degree represents a soap-destroying power equivalent to that produced by one grain of chalk per gallon.*)
The oxygen required by the changeable organic and other oxidisable matter amounted to none parts per million of the water.

On distillation the sample yielded:—

Free ammonia	·05 parts per million.
Albuminoid ammonia	·08 „ „

The results recorded under the heads of "chlorine," and "nitrogen existing as nitrates and nitrites," show that the water is not of unexceptionable origin, but the figures under the heads of "oxygen required," "free ammonia," and "albuminoid ammonia," point to a present satisfactory freedom of the water from objectionable traces of readily changeable or putrescible nitrogenous organic matter. Taken generally, the analytical results afford no indication that the water is unfit to drink.

(Signed) ALFRED H. ALLEN.

(B.)

PINCH MILL SPRING.

No. 1, Surrey Street, Sheffield,
November 12th, 1886.

REPORT on a SAMPLE of DRINKING WATER received from the CORPORATION of the BOROUGH OF ROTHERHAM, on October 26th, 1886. Sample Mark, "No. 29."

Physical characters:—

The sample contained no suspended matter.
Appearance of a column two feet in length, clear and colourless.
Taste, normal.
Smell, none.

On analysis, the sample gave the following results:—

Total solid matter	21·84	grains per gallon.
Non-volatile matter	13·58	„ „
Loss on ignition	8·26	„ „
Chlorine	1·50	„ „

(*Equivalent to chloride of sodium*, 2·47 *grains.*)
Nitrogen, existing as nitrates and nitrites, high.
Lead and other poisonous metals, none.

The sample had a hardness of 12·5 degrees. (*Each degree represents a soap-destroying power equivalent to that produced by one grain of chalk per gallon.*)

The oxygen required by the changeable organic and other oxidisable matter amounted to ·00 parts per million of the water.

On distillation the sample yielded:—

Free ammonia	·03 parts per million.
Albuminoid ammonia	·06 „ „

The results recorded under the heads of "chlorine" and "nitrogen " existing as nitrates and nitrates," show that the water is not of an unexceptionable origin, but the figures under the heads of "oxygen required," "free ammonia," and "albuminoid ammonia," point to a present satisfactory freedom of the water from objectionable traces of readily changeable or putrescible nitrogenous organic matter. Taken generally, the analytical results afford no indication that the water is unfit to drink.

(Signed) Alfred H. Allen.

(C.)

Wellgate Spring.

Public Analyst's Laboratory,
67, Surrey Street, Sheffield,
October 3rd, 1890.

Report on a Sample of Drinking Water received from the Corporation of the Borough of Rotherham, on September 29th, 1890. Sample Mark, "No. 44."

Physical characters:—

Suspended matter, none.
Appearance of a column two feet in length, clear and colourless.
Taste, normal.
Smell, none.

On analysis, the sample gave the following results:—

Total solid matter	35·14	grains per gallon.
Non-volatile matter	26·63	„ „
Loss on ignition	2·35	„ „
Chlorine	8·51	„ „

(*Equivalent to chloride of sodium*, 3·87 *grains.*)

Nitrogen, existing as nitrates and nitrites	0·93	„ „

(*Equivalent to anhydrous nitric acid*, 3·59 *grains.*)
Lead and other poisonous metals, none.

The sample had a hardness of 16·2 degrees. (*Each degree represents a soap-destroying power equivalent to that produced by one grain of chalk per gallon.*)

The oxygen required by the changeable organic and other oxidisable matter amounted to 0·19 parts per million of the water.

On distillation, the sample yielded:—

Free ammonia	0·01	parts per million.
Albuminoid ammonia	0·06	,, ,,

These results are not satisfactory. The proportion of chlorides and trates are in excess of those met with in water of unexceptionable igin, and point to contamination to a notable extent by drainage or milar impurity. The polluting matter has subsequently undergone lerably complete destruction by oxidation; but as a change of conditions ight interfere with this process of spontaneous purification, the water ust be regarded with serious suspicion, and if its use for drinking be ntinued its effects should be carefully watched.

(Signed) Alfred H. Allen.

(D.)

High Level Tap Water.

Public Analyst's Laboratory,
67, Surrey Street, Sheffield,
September 25th, 1891.

Report on a Sample of Drinking Water, received from the Corporation of the Borough of Rotherham, on September 10th, 1891. Sample Mark, "No. 51."

Physical characters:—

Suspended matter, none.
Appearance of a column two feet in length, clear and colourless.
Taste, normal.
Smell, none.

On analysis, the sample gave the following results:—

Total solid matter	24·64	grains per gallon.
Non-volatile matter	23·24	,, ,,
Loss on ignition	1·40	
Chlorine	1·55	,, ,,
(*Equivalent to chloride of sodium*, 2·55 *grains.*)		
Nitrogen, existing as nitrates and nitrites	0·46	,, ,,
(*Equivalent to anhydrous nitric acid*, 1·77 *grains.*)		
Lead, and other poisonous metals, none.		

The sample had a hardness of 12·0 degrees. (*Each degree represents a soap-destroying power equivalent to that produced by one grain of chalk per gallon.*)

The oxygen required by the changeable organic and other oxidisable matter amounted to 0·72 parts per million of the water.

On distillation, the sample yielded:—

Free ammonia	0·02	parts per million.
Albuminoid ammonia	0·10	,, ,,

These results show the water to be fairly free from readily changeable organic matter, though there is evidence of the partial origin of the water in the drainage from cultivated land.

(Signed) Alfred H. Allen.

App. A. No. 7.

On an Outbreak of Enteric Fever in Rotherham, Rawmarsh, and Greasbrough: by Dr. Theodore Thomson.

(E.)

LOW LEVEL TAP WATER.

Public Analyst's Laboratory,
67, Surrey Street, Sheffield,
October 12th, 1891.

REPORT on a SAMPLE of DRINKING WATER received from the CORPORATION of the BOROUGH of ROTHERHAM, on September 30th, 1891. Sample Mark, "No. 52."

Physical characters:—

Suspended matter, none.
Appearance of a column two feet in length, clear and colourless.
Taste, normal.
Smell, none.

On analysis, the sample gave the following results:—

Total solid matter	20·86	grains per gallon.
Non-volatile matter	19·60	" "
Loss on ignition	1·26	
Chlorine	1·70	" "
(*Equivalent to chloride of sodium*, 2·80 *grains.*)		
Nitrogen, existing as nitrates and nitrites	0·46	" "
(*Equivalent to anhydrous nitric acid*, 1·77 *grains.*)		

Lead, and other poisonous metals, none.

The sample had a hardness of 12·6 degrees. (*Each degree represents a soap-destroying power equivalent to that produced by one grain of chalk per gallon.*)

The oxygen required by the changeable organic and other oxidisable matter amounted to 0·63 parts per million of the water.

On distillation, the sample yielded:—

Free ammonia	0·16	parts per million.
Albuminoid ammonia	0·16	" "

The proportions of chlorides and nitrates are in excess of those met with in water of unexceptionable origin, the abnormal figures being doubtless due to the partial origin of the water in drainage from cultivated land. The figures recorded under the heads of "free ammonia" and "albuminoid ammonia" point to the presence of undesirable traces of readily changeable organic matter.

(Signed) ALFRED H. ALLEN.

No. 8.

Report on an Outbreak of Typhoid Fever in the Borough of King's Lynn, Norfolk (1892); by Dr. R. Bruce Low.

The Board received, on March 25th, an intimation from Mr. S. M. W. Wilson, the Medical Officer of Health of the Urban Sanitary District of King's Lynn, that an outbreak of typhoid fever had occurred there; and on April 18th Mr. Wilson, in compliance with the Board's request, further reported on the epidemic. In view of the facts thus elicited, the Board decided on an investigation of the outbreak by an officer of the Medical Department, and I was entrusted with this duty. Owing to other official engagements I was not able to visit the locality till May 31st, on which day and subsequently I made the investigation.

On arriving at King's Lynn I ascertained that the outbreak had also implicated Gaywood, practically a suburb of King's Lynn, though situated in the Freebridge Lynn Rural Sanitary District, and accordingly I received instructions to extend my inquiry into the latter district.

King's Lynn Urban Sanitary District.

The borough of King's Lynn, with an area of 3,099 acres, had at the last census a population of 18,265. The town, which lies on the right bank of the Ouse, a navigable river at this point, is about a mile and a half long by about half a mile broad. It is built upon an alluvial flat, and is intersected at various points by four rivulets, or "fleets" as they are locally termed, which empty themselves into the river. Many of the streets in Lynn are narrow, and in certain quarters there are courts or yards thickly populated and entered by narrow passages. These courts or yards, many of which are unpaved, are frequently surrounded by high walls which exclude sunlight and prevent free circulation of air. Dwellings in these courts are not infrequently in bad repair, and they tend to be overcrowded. In business quarters of the town as, for instance, in King Street, parallel with the river front, and in the more recently built parts of Lynn, the streets are more open and houses are larger and of a better class.

The population is employed in a variety of ways; at the docks, at two large iron works, at flour and oil mills, and, in addition, in the usual trades and occupations of a country town. There are about 100 fishing boats sailing from the port, and these employ between 300 and 400 hands.

The public drainage consists, in the older parts of King's Lynn, of short sections of brick sewers, constructed some years ago and discharging by different outfalls directly into the Ouse or into one or other of the fleets. For the northern and eastern part of the town a long length of sewer was, a few years ago, laid down. This sewer, which receives the sewage of more than half of the houses in the town, has an outfall near the old dock, and is generally known as the "dock culvert." For a considerable distance it is an egg-shaped brick sewer, and throughout it is ventilated at intervals by openings at the street level. Here and there shafts have been carried up above the level of the house roofs. There are several automatic flushing tanks at the ends of branch sewers. Few of the sewers appear to be self cleansing. Deposit takes place in nearly all of them. The tide dams up the sewage in all for several hours daily. Private drainage is effected by ordinary pipe drains. Gullies in yards

are mostly trapped. Rainfall pipes usually pass directly into the drains. In some cases sink pipes are not disconnected, but the majority of houses have no sinks indoors. Soil pipes in some cases are ventilated; much improvement in this respect has been effected of late.

Excrement disposal is now in large part by waterclosets, the majority of which are situated out of doors. The closets are supplied with flushing boxes, and generally they are kept clean and in good repair. It is estimated that there are still about 1,600 privies in the town. The privy pits, many of them uncemented, are often sunk 2 or 3 feet below the level of the ground. They are emptied by the Sanitary Authority's workmen; a few owners, who prefer to see to the cleansing of their own privies, deposit their privy contents on land outside the town. A few privies have moveable receptacles. In some courts the closet accommodation is inadequate. Thus I saw an instance where there was provided a double privy over a single pit (6 ft. × 3 ft. × 3 ft.) for eight houses containing 30 persons. Privies are occasionally too close to the dwellings. In the process of emptying some privy pits the contents have to be carried through the houses.

Refuse disposal.—House refuse is commonly stored in moveable receptacles, which are emptied by the employés of the Sanitary Authority. But in some confined yards refuse is thrown into a corner and causes nuisance. The ashes and house refuse, together with the filth from privy pits, are carted away by the Sanitary Authority to a tip on the southern outskirts of the town. This stuff is sold as manure to farmers and others. At the date of my visit there was an accumulation at the tip, estimated to consist of about 2,000 loads. The refuse, before sale, is roughly sifted, so as to remove bottles, tins, or such articles.

The water supply is drawn from the Gaywood or Grimstone River, which rises about 7 miles away, in a series of springs issuing from the chalk in and around the village of Grimstone. The river fed by the water of these springs flows, in its passage to the town, through cultivated land and meadows. In the last mile and a half of its course the river skirts the village of Gaywood, some cottage gardens of which, as well as of houses in Gaywood Road, abut upon the river bank. The intake is close to the town and within the borough boundary.

Dairies and cowsheds are registered, and regulations respecting them have recently been allowed by the Local Government Board.

Slaughter-houses are registered. Byelaws for regulating them were allowed in 1884.

Byelaws relating to nuisances, to new streets and buildings, and to markets were also allowed in 1880. A series of regulations for private drains, under section 21 of the Public Health Act, 1875, was adopted by the Sanitary Authority on March 19, 1884.

Infectious diseases.—The Infectious Disease (Notification) Act of 1889 has been adopted, and came into force in the borough on March 1, 1890. Three years ago an instalment of a new isolation hospital was erected on the southern outskirt of the town, with accommodation for six beds. The plan provides for another pavilion of the same dimensions as the first. There exists on the site an old cottage, adjoining the hospital and connected with it by a covered way. This cottage can be made use of for administration purposes; the nurse sleeps here, and cooking is also done in it for the patients. Only one case (of scarlet fever) has, however, been treated in the hospital since it was built.

The only disinfection of clothing, bedding, &c., practised, is fumigation by burning sulphur in a chamber.

The Infectious Disease (Prevention) Act of 1890 has been adopted, and came into force on August 1, 1891.

The Public Health Acts Amendment Act of 1890 similarly came into force on September 15, 1891.

The King's Lynn Urban Sanitary Authority is also the Sanitary Authority for the King's Lynn Division of the Port of Lynn.

Gaywood, in the Freebridge Lynn Rural Sanitary District.

Gaywood had a population, at the last census, of 952, with an area of 2,335 acres. It adjoins King's Lynn on its eastern outskirt, and is practically a suburb of that town. The centre of Gaywood is not more than three-quarters of a mile from the borough, and there is constant daily communication between the two places.

Sewerage.—The sewers of King's Lynn extend into the village of Gaywood. There are roadway ventilators along the main sewer, and a flushing tank is situated at the point where the sewer from Gaywood joins the borough main sewer.

Excrement disposal is mostly by pit privies situated in back yards or gardens. These pits are emptied at long intervals by the occupiers, and the contents are spread upon their gardens or allotments.

House refuse is accumulated in uncovered ashpits or in heaps on private premises to be afterwards disposed of upon land.

Water supply.—A considerable part of the village is supplied with the Lynn town water service, but some houses at the eastern extremity of the village derive their supply from two shallow wells. A few persons whose gardens abut upon the river, or are near it, get water by "dipping" from the river.

Typhoid Fever at King's Lynn.

Typhoid fever is by no means a new disease in King's Lynn. During the last ten years this malady has, in nearly every year, been causing mortality in the town. From the local death returns I have constructed the following table relating to fatal typhoid fever and diarrhœa in King's Lynn from 1882 to 1891 inclusive:—

Table I.—Showing deaths from Typhoid Fever and from Diarrhœa and Dysentery in the borough of King's Lynn from 1882 to 1891, inclusive.

——	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.
Deaths from typhoid fever	1	2	3	5	5	2	1	2*	4†	—‡
Deaths from diarrhœa and dysentery.	9	5	19	8	10	3	5	8	9	5

* Seven cases of typhoid came under notice of Medical Officer of Health. Three of them were landed ill from ships arriving at the port.
† Notification came into force March 1st. To the end of the year, ten cases were notified.
‡ During 1891 thirteen typhoid cases were notified.

PP. A. No. 8.

An Outbreak Typhoid Fever King's Lynn; Dr. Low.

As regards prevalence of typhoid fever since Notification came into force, there occurred between September 1890 and February 1891, a small crop of 10 cases of this fever. From February till September 1891 no case of the disease was notified in the borough. But in September and in succeeding months, this disease again began to show itself, so that by December 31 ten cases had occurred in King's Lynn. Meanwhile three cases of fever had occurred in Gaywood, only one of which was notified, as will be seen later on.

During January and early February 1892 only one case of typhoid fever was reported in the borough, and, so far as could be learned, diarrhœa was not more prevalent than usual in the place.

History of the Outbreak of 1892.

The recent epidemic of definite "fever" was preceded by a severe and widespread outbreak of diarrhœa, which dated from the last three days of February, viz., 27th, 28th, and 29th. The diarrhœa of this outburst attacked all classes of persons and invaded most localities in the town. Sometimes every member of an invaded household suffered. In the majority of cases the illness lasted a week or 10 days; and in many cases there were along with the diarrhœa symptoms, elevation of temperature and sometimes sore-throat. Early in March, with the waning of the diarrhœa outburst, more pronounced symptoms of typhoid fever began to appear, and such cases soon became numerous. Afterwards, during April, May, and early June, though fever cases continued to occur, they were in fewer numbers, many of them being secondary cases in previously invaded houses.

On my arrival in King's Lynn I conferred with Mr. Wilson, the Medical Officer of Health for the borough, and with Dr. Plowright, the Medical Officer of Health for the Freebridge Lynn Rural Sanitary District. From these gentlemen I learned that at the beginning of the outbreak under investigation there existed some difference of opinion as to the nature of the malady which was manifesting itself in the borough. It appears that influenza had been epidemic in the neighbourhood about the end of 1891; and, when at the end of February 1892 a sudden increase of illness accompanied with diarrhœa appeared, the opinion formed by some of the medical men was that "gastric influenza" afforded an explanation of the symptoms. Even up to the date of my arrival in Lynn this opinion was still held by some, who contended that typhoid fever did not and had not existed in the borough. In reference, therefore, to this doubt as to the nature of the current malady, I took the opportunity, in company always with the medical men in attendance, of visiting several of the patients who were still under medical treatment. From what I saw I had no hesitation as to the disease being typhoid fever. At the same time it is not to be denied that a number of the earlier cases failed to present in a definite way the customary symptoms of this disease, and consequently, I can well understand there having been, at first, hesitation as to diagnosis. But, however this may have been, later experience of the cases induced the medical men of Lynn, almost without exception, to agree in pronouncing the current fever to have been true typhoid fever.

From Table II. a general view of this epidemic illness may be gathered. This table, while including all fever-stricken households, does not pretend to comprise the whole of the houses invaded by diarrhœa. As regards the latter malady only those households are taken into account respecting which definite information was obtainable.

Table II.—Showing month by month, from September 1891 to June 1892, the ascertained number of houses invaded by Diarrhœa or by "Fever" in King's Lynn and Gaywood, with the total attacks in such houses, and the deaths.

Year.	Houses invaded by Diarrhœa or Fever.	Total Attacks in such Houses.	Deaths from Fever or Diarrhœa in each Month.
1891.			
September	1	1	—
October	1	1	—
November	4	11*	—
December	5	6	—
1892.			
January	3	6	1
February	25	58	1
March	44	92	3
April	15	22	5†
May	10	14	1
June	15	15	5
	123	226	16‡

*Eight of these cases occurred in one house at Gaywood within the period from the middle of November 1891 to the middle of March 1892. Every inmate of the house was attacked in succession, but none of the cases were notified. *see* p. 78.

†This figure includes the death of a child aged two years, certified as due to "tuberculosis and enteritis, one month." But inasmuch as three cases of enteric fever occurred shortly afterwards in the same household, the medical attendant has now little doubt that this child's fatal malady was enteric fever also.

‡Of the 16 deaths only one was certified from diarrhœa, viz., a child aged 13 months, in which case "teething" was given also as a cause of death. A relative was at the time ill with diarrhœa, which lasted a fortnight.

Separating the cases subsequently recognised as typhoid fever from cases that appeared to have been diarrhœa only, I have placed in Table III. the number, from January to June, of houses invaded week by week by unquestionable typhoid fever.

Table III.—Showing number of houses invaded by illness that proved to be Typhoid Fever in King's Lynn and Gaywood in each week from January 1st to June 11th, 1892.

January.				February.				March.				April.					May.				June.	
9	16	23	30	6	13	20	27	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11
—	—	—	1	—	—	—	1	13	12	11	3	2	4	4	1	—	5	2	1	1	3	2

Note.—The dates of attack refer to the onset of diarrhœal symptoms, which in many cases preceded by a week or more development of actual fever. Some difficulty was, in several instances, found in fixing the precise commencement of illness, and the dates therefore are approximate only. They are, however, believed to be substantially correct.

Of the total 226 cases of illness mentioned in Table II., 91 were referred to diarrhœa, and 135 to typhoid fever. As regards 124 of the recognised typhoid fever cases which had occurred up to the date of my

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inquiry, I give, in Table IV., the facts as to sex and age. In Table V. are given similar facts respecting the first sufferers by fever in invaded families.

Table IV.—Showing incidence as to age and sex in 124 cases of Typhoid Fever occurring in King's Lynn and Gaywood from September 1891 to June 1892.

——	At all Ages.	Under 5.	5 to 10.	10 to 15.	15 to 25.	25 to 35.	35 and upwards.
Males - -	66	3	12	18	13	8	12
Females	58	7	10	8	15	5	13
Total -	124	10	22	26	28	13	25

Table V.—Showing incidence as to age and sex in first sufferers by Typhoid Fever in families invaded during the period from February 27th to March 31st.

——	At all Ages.	Under 5.	5 to 10.	10 to 15.	15 to 25.	25 to 35.	35 and upwards.
Males .	27	2	4	7	5	6	3
Females -	14	3	5	2	—	1	3
Total - -	41	5	9	9	5	7	6

Of the total 135 recognised typhoid fever cases occurring from January to June, 116 were referred to King's Lynn and 19 to Gaywood. This number, 135, is not, however, to be regarded as representing the full extent of the fever epidemic. The diarrhœa attacks which ushered it in, and which cannot be dissociated from the fever that followed, were estimated by various authorities at "hundreds," and, as has been said, affected rich and poor quarters of the town alike; no class or age* appearing to escape. Many, no doubt, were slight cases, and a number of these were treated by local druggists; only the severer cases, some of which lasted two, three, or even four weeks, came under medical observation. But medical testimony goes to show that these diarrhœal attacks were characterised by feverishness and abdominal tenderness, with the diarrhœa. The stools were light in colour, and in a few instances contained streaks of blood. There was commonly persistent headache with subsequent prostration and in some cases loss of flesh. Sometimes it was found that while several members of the household or even the whole family were attacked with diarrhœa, only one of them was subsequently recognised to have developed typhoid fever, during continuance of an illness which dated its commencement from the diarrhœa from which the family generally had suffered. The following

* The master of St. John's Boys' School, on referring to his log book, informed me that the attendance for the week ending March 4th was "thin," and he says parents sent word to him that their children could not come to school as they were ill with diarrhœa.

is an example:—On the afternoon of Saturday, February 27, Mr. I.'s child, aged 21 months, showed symptoms of indisposition. During the evening diarrhœa set in, accompanied by sickness and abdominal pain. Next day Mr. I. himself was similarly attacked, and the same day, February 28th, his son, aged 9, complained of chilliness. On the evening of Monday, February 29th, this boy had an attack of diarrhœa and vomiting. Dr. Plowright was called in, and continued to attend him during his illness. Notification of the case, as typhoid fever, was received by the Medical Officer of Health on March 9th. This boy passed through an ordinary attack and made a good recovery.

In further illustration of the kinship of this Lynn diarrhœa to continued fever, I cite some facts given to me by Dr. R. Henslowe Wellington, Medical Officer of Health for the Urban Sanitary District of Sutton Bridge, about 10 miles from King's Lynn, to which place cases of the Lynn illness were imported in the persons of three boys belonging to two families. The boys were weekly boarders at the same school in Lynn and came home about March 4th, suffering from diarrhœa. They had been ill most of the week before they came home. Dr. Wellington was called in; he describes the illness as consisting of diarrhœa, attended with fever, great lassitude, tenderness of abdomen, and slight gurgling in the cœcal region; "the stools were very suspicious of typhoid." There was headache and flushing of the face. The temperatures of these boys were not taken regularly, but Dr. Wellington says he remembers one of the cases reaching 104° F. The duration of the illness in each case was from first to last about three weeks. In one of the two houses a servant became ill, "about 10 days after the boy's arrival," with the same symptoms as given above. Her attack lasted only two weeks. Previous to the boys coming home there had been no diarrhœal illness in Sutton Bridge.

It is not unusual in widespread epidemics of typhoid fever to find mild or anomalous cases side by side with severer ones, and scepticism as to the nature of the anomalous cases has sometimes been attended with disastrous consequences where their bowel discharges have been allowed to poison the soil and the air, and ultimately the water or food. To this point I shall have occasion to refer again further on. Whether this Lynn diarrhœa was, as I am inclined to believe, a manifestation of reception of the typhoid poison, or was a malady distinct from the fever, it appeared not unlikely that both the diarrhœa and the typhoid fever had owed their dissemination to the same local circumstances.

Sanitary Administration in reference to the Outbreak.

During the epidemic no typhoid fever cases were admitted to the Borough Isolation Hospital, but several patients were treated in the general wards of the West Norfolk and Lynn Hospital, which is within the borough boundary. Disinfectants were issued freely to all applicants. The town sewers were flushed daily and a large quantity of carbolic acid was introduced into them each day. The clerk to the Urban Sanitary Authority published on April 9th a handbill calling the attention of the people of Lynn to the statements of the Medical Officer of Health as to the danger attending the existence of certain structural defects in connexion with drains, &c., as follows:—

"The inhabitants of any house having any of the following common sanitary defects run a very grave risk of contracting dangerous preventible disease. Sinks and overflow pipes in direct communication with a sewer, whether trapped or untrapped; defective waterclosets especially if inside houses; leaky drains running underneath houses; untrapped rain water pipes near windows."

The handbill further requested that where any such defects existed, information thereof should be given to the borough surveyor.

Under date April 12th, Mr. Wilson, the Medical Officer of Health, sent a letter to the local newspapers recommending the inhabitants of Lynn to boil all water used for drinking purposes. In his letter Mr. Wilson pointed out that the public water supply was liable to contamination at all times. Later on Mr. Wilson repeated his advice about boiling the drinking water.

The Cause of the Outbreak.

In proceeding to make inquiry as to the cause of the outbreak various possible factors of fever were taken into consideration. The chief of them are represented by milk supply, sewer air in its relation to excrement disposal and drainage circumstances, and water supply: these will now be discussed in the above order.

Milk supply.—This possible cause of the fever had been investigated by the Medical Officer of Health and by the Inspector of Nuisances, but with negative results. I, however, made inquiry again into the matter so far as the first 50 attacks of the outbreak were concerned. Their milk supplies appear to have been many and various. Ten of the families first attacked used no milk at all; some others only used it in small quantities in tea; and, further, these milk supplies in question came from 28 different sources. No milkman had more than three of the 50 fever cases on his list of customers. It was obvious, therefore, that the hypothesis of contamination of one or another milk service could not afford a satisfactory explanation of the outbreak. Meanwhile the circumstance that the milk sources of invaded houses had been many and various appeared in itself testimony of the wide diffusion of the fever. Similarly, the fact that no milk retailer had among his customers more than three invaded families appeared to indicate that within the total area affected there was no very exceptional localisation of the disease.

Excrement disposal.—The waterclosets of the place had been thought of as giving vent to specifically polluted sewer air in and about houses, and as having thus conduced, perhaps, to dissemination of the fever. Now there are in Lynn some 2,300 waterclosets, but no more than 1,600 privies; so that, on a hypothesis that waterclosets operated in the above way to cause fever, a larger incidence of the disease was to be expected on houses having waterclosets than on houses furnished with privies. But on investigation this was not found to be the case, as is shown in Table VI.:—

Table VI.—Giving the number of houses invaded by Typhoid Fever from January to June 1892, and distinguishing houses having waterclosets from houses having privies.

Month of 1892.	Houses invaded by Typhoid Fever.		Total.
	Provided with *Waterclosets.*	Provided with *Privies.*	
January and February - -	2	5	7
March - - - -	17	18	35
April - - - -	7	3	10
May - - - -	2	7	9
June (to 11th) - - -	5	—	5
January to June - -	33	33	66

It is here seen that, relatively to their numbers, houses furnished with waterclosets suffered less, not more, than houses furnished with privies; and that this different incidence on these two classes of dwellings was manifest at the very commencement of the epidemic. Accordingly waterclosets as distributors of specifically polluted sewer air can have had little to do with dissemination of the fever. On the other hand at no time during the epidemic was there such excess of incidence of fever on houses provided with privies as to support a thesis that privies themselves had important concern in fostering the fever. The facts indeed respecting the different methods of excrement disposal in use at invaded houses are consistent, as were also the facts respecting milk service, rather with a cause of fever suddenly introduced *ab extra* to the town, and affecting at once a wide area, independent alike of waterclosets and privies as media for its operations.

Drainage circumstances.—But whether waterclosets had or had not been at fault in the sense above referred to, the sewers of Lynn remained—at any rate from the local view-point—under suspicion of being concerned in the fever; as having so to speak fostered within them the material of the disease, which had, along with sewer air, afterwards found vent, if not by means of closets perhaps by way of street and yard gullies, or through rain spouts and slop sinks in the neighbourhood of houses. And in the main a particular sewer, or section of sewers, was thought of as having operated in this fashion. It had been noticed, for instance, that many of the fever cases had occurred in houses situated in streets served by the "dock culvert," the sewer referred to at page 67 as receiving the sewage of more than half the houses in the borough.

The sewer in question commences in the London Road to the south-east of the town and discharges into the Ouse near the old dock at the northern extremity of the Urban Sanitary District. It was constructed as part of a general scheme that was ultimately to convey the sewage of the whole of Lynn to a single outfall on the confines of the town. Though the most modern of the Lynn sewers, this dock culvert, owing to the flatness of the area it serves, and owing also to defects in its construction, is a "sewer of deposit." Moreover, it is tide-locked for several hours each day, and the means for flushing it are not efficient. As already stated, there are roadway ventilators in the course of this sewer, and when the wind blows from the westward into the mouth of the sewer, unpleasant smells are noted as emanating from these ventilators. The defects of this sewer have been under the consideration of the Sanitary Authority for the last three or four years, and the Borough Surveyor has recommended that part of it be relaid.

But, as has been said, the dock culvert serves a portion only of the town. In addition there are many other sewers discharging by ten or a dozen outlets directly to the Ouse, or indirectly thereto by way of the "fleets," which are in connexion with the river. They are of brick, and all of them are, like the dock culvert, dammed up by the tide for several hours daily.* Nor are they, again like the dock culvert, self-cleansing; foul sludge deposits in them and smells from their ventilators at the street level are often complained of. Further, it needs to be noted of sewer emanations generally in Lynn, that these rarely have opportunity of passing directly into dwellings; comparatively few of

* The Borough Surveyor informs me that, roughly speaking, the doors of the dock culvert outfall are closed six hours at spring tides and four hours at neap tides.

the Lynn houses have sinks within them, and indoor waterclosets are not common.

Upon making investigation of the fever with reference to the several separate drainage areas of Lynn and Gaywood, it soon appeared that the population on the dock culvert sewer system had indeed suffered early and much from fever, and so far the local belief of special association of this sewer with the epidemic was not without justification. But at the same time other facts also appeared which afforded ground for hesitation in accepting this explanation of the fever prevalence as a whole, as is seen from Table VII. :—

TABLE VII.—Showing, as regards the 41 households earliest invaded by Typhoid Fever, the number having, and the number NOT having, relation direct or indirect with the DOCK CULVERT. In addition, the table gives in each instance the total population involved, and the nature of the closet accommodation of invaded houses.

Drainage Area.	Houses invaded.			*Invaded Houses per 1,000 of Population in each instance.*
	Provided with Water-closets.	Provided with Privies.	Total invaded.	
Area, in Lynn and Gaywood, served by the dock culvert. (Population about 10,300.)	12	15	27	2·6
Area, in Lynn and Gaywood, served by other and multiple sewer systems. (Population about 8,800.)	7	8	15	1·7

It thus appears that though houses on the dock culvert system suffered exceptionally from fever, the disease was by no means confined to the district served by the main sewer in question. And further it appears, as regards invaded houses generally, that, whatever the sewer system of the locality in which they were found, their sewer connexions are likely to have had little to do with their invasion by fever, since invaded houses provided with privies and having therefore minimum of relation with sewers were more numerous than invaded houses furnished with water-closets and having as a consequence sewer relations of more than one sort. In a word, there is suggestion in Table VII. of a factor of fever independent alike of drainage circumstances and of method of excrement disposal, and operating on all parts of the town.

Water supply.—The majority of the chalk springs which combine to form the Gaywood River from which Lynn derives its water supply rise, as has been said, in and around the village of Grimstone, six miles distant. The intake, however, is situated close to the town, and is within the borough boundary. The river water here passes into a "lake," which acts in some measure as a reservoir from which the water is transferred to two small filter beds, which have between them a combined area of little over 200 square yards. The filtering materials consist of a layer of coarse gravel about 18 inches thick, and a layer of finer gravel about 14 inches thick. The surface of the filtering material is roughly cleansed once a week by stirring it about with strong

brushes, and thus detaching accumulated dirt, which is allowed to flow off into the river below the intake. From the filtering beds the water flows into a well from which it is pumped into a tank upon a tower, whence it is distributed by gravitation to the town. The capacity of the distributing tank is about 13,000 gallons.

Some people in Lynn complain that after heavy rains the water is thick and discoloured, and that if allowed to stand it deposits a sediment and occasionally "stinks." Sometimes a dead eel or a small frog is found stuck fast in the water pipes. The feeders of the river receive more or less directly the slop water of Grimstone village, while soakage from privy pits and refuse heaps, as also drainage from farmyards and horse-ponds, sooner or later find their way into these tributaries. Two of the springs rise directly from beneath Grimstone churchyard. In addition to the above sources of impurity, the slop waters from the hamlets of Roydon, Bawsey, and Pot Row similarly find their way ultimately into the *stream*. At Grimstone, and again at Roydon, I saw the overflow pipe of a cesspool, receiving contents of watercloset, discharging into a watercourse which flows into the Gaywood River. Similarly, the drains from a slaughter-house, a public-house urinal, and the washings of a laundry empty into watercourses which discharge directly into the stream. And nearer the town, at Gaywood, gardens, manured from time to time with the contents of privy pits, abut upon the river.

In the course of my inquiries, I visited a market garden at Gaywood, about a mile or so above the intake. This garden has a frontage to the river of about 200 yards. On the surface of this garden I saw traces of town manure from the "tip" where privy filth is deposited; it had been spread on patches, about 19 yards from the water's edge. Failing to obtain definite information from the workers in the garden, I applied to the corporation officials, who told me on referring to their books that this gardener had at times purchased town manure. He had a supply in September last, and during the present year he had supplies as follows:—on January 18th, two loads; on February 4th, one load; on March 9th, one load; and on April 29th, one load.

From what has been stated it is evident that the water in the Gaywood River has multifarious opportunities for becoming polluted by human excrement, not to speak of other impurities directly discharged into it or washed into the stream by heavy rains or melting snow. The filtering process, even if it were adequate, which it is not, cannot be trusted to prevent the danger of the specific fever poison thus passing into the town water mains. As to this, it needs to be noted that the excrement and refuse depôt of the Sanitary Authority had, in all probability, by the beginning of 1892, become "leavened," more or less, with typhoid fever poison through the specific bowel discharges of fever patients. There had been at least 11 recognised cases of typhoid fever in the borough between September 1891 and January 1892; so that infected filth from the Sanitary Authority's depôt spread on a garden patch only 19 yards from a public water supply, and likely therefore to be washed into it by heavy rains might, quite possibly, have given rise to specific contamination of that supply. Be this as it may, there remains still another source of specific pollution to be described, which by itself may be thought of as sufficing to account for the outbreak.

This other source of possible infection comprised a series of cases of illness that can hardly have been other than typhoid fever, occurring during the winter of 1891–92, in a family which I will call X, residing in a house on the outskirts of Gaywood.

The history of this series is as follows :—

Mr. X, aged 55, who had been in delicate health for some years, was taken ill on November 17th, 1891, with general malaise and shivering. During the first week of this illness he began to suffer from diarrhœa. He had feverishness, delirium, and a dry brown tongue. His motions were offensive and were light in colour. He was acutely ill for about four weeks, when convalescence set in. He had lost all the above symptoms, and appeared to be making a good recovery, when a few weeks later he began to "cough and spit." He died on March 7th, and his death was certified as due to tuberculosis. At the first onset of Mr. X's illness, in November, a medical man was called in, and this gentleman's suspicions were aroused by what he termed the "typhoid" condition of the patient, and he communicated his suspicions to Dr. Plowright, the Medical Officer of Health for the rural district, stating he would not notify the case till he was quite certain as to the diagnosis. Unfortunately, for some reason or other, the family only permitted the doctor to call at intervals, and he, therefore, had fewer opportunities for seeing the case than the serious illness of the patient demanded. In the end the case was not notified, the medical attendant not being able to speak positively as to the precise disease from which the patient had suffered. The case, I understand, was looked upon as one of "gastric influenza" attacking a patient who was the subject of chronic tubercle. Mr. X was nursed by his wife. On or about December 10th Mrs. X was taken ill with shivering, fever, headache, parched tongue, abdominal tenderness, deafness, and diarrhœa. Her motions were light coloured. She was ill "about four weeks." Some time early in January her son, aged 15, began to suffer with diarrhœa and other symptoms much the same as those of his mother, but his ailment seems to have been of a mild character; he was only laid up, so his mother says, "about a week." Later in January a daughter, aged about 20, was also taken ill; she had diarrhœa and other symptoms similar to those of her father, mother, and brother. In addition, she had a "bad throat" and some chest symptoms. She remained ill "about three weeks." During February three other daughters of the family, aged respectively 12, 22, and 10, were taken ill with diarrhœa, feverishness, and other symptoms, precisely similar to those described above. The youngest of these girls had also sore-throat; her illness was of a more severe character; sordes formed on her lips, and she did not recover for six or seven weeks from the onset of the illness. The only remaining member of this household, a daughter, aged 24, who had hitherto escaped, was prostrated with illness about March 14th. Her symptoms were fever, delirium, diarrhœa (the motions being pale in colour), deafness, dry brown tongue, &c. She was ill, her mother says, "about three weeks."

Some of these cases were never seen by the family medical attendant, and the others only occasionally. He was consulted in regard to them at irregular intervals on account of what was believed to be their "influenza" attacks; hence he had little chance of recognising the true nature of the disease. For this reason none of the cases were notified.

In all, at this house at Gaywood, eight cases, having the same symptoms, namely, fever and diarrhœa, followed one another, at short intervals, from November 1891 to March 1892. At one of my visits to the X's house I had the benefit of Dr. Plowright's company, and at my request Mrs. X detailed to him, as she had previously detailed to me, the symptoms of each individual sufferer in this series of cases. Dr. Plowright arrived at the same conclusion that I had done, viz., that each of the eight patients had suffered from an attack of typhoid fever.

The house in which the eight cases occurred has a box privy at the back. The box, I was informed, is frequently emptied upon the garden, which extends from the house to the river bank, a distance altogether of 50 yards, with a gradual slope from the house to the river. The privy

was used by each of the patients in the early part of their illness; but when they were confined to bed the bowel discharges were carried down the garden to a shallow pit or trench dug, for convenience, at the side of the garden path; the pit or trench was situated a distance of 35 yards from the Gaywood river's brink.

By the middle of February 1892 six, or perhaps seven, of these typhoid cases had occurred; and, as their illness had continued off and on from November, there must have been a considerable accumulation of typhoid excrement in the pit, which is said to have been about 2 feet square and about 2 feet in depth; and as the box privy containing the earlier dejections of the patients had been, during the above period, frequently emptied at various places in the garden, the ground surface there must also have retained specifically contaminated excrement. How these dangerous dejecta may have been suddenly transferred to the river will now appear.

During the three days, February 7th, 8th, and 9th, there occurred a rainfall of 0·96 inch, 0·80 inch of which fell on February 8th. This wet weather was followed by a few fine days with frosty nights. But on February 14th rain and snow fell heavily, followed on succeeding days by more snow and by severe frost, which "broke" on the night of February 20th. In all, the rainfall (largely consisting of snow), from the 14th to the 21st February inclusive, measured no less than 1·24 inches, and it was distributed, day by day, as follows:—

	Inches.	
February 14	0·34	Rain and snow.
„ 15	0·06	Rain, snow, and sleet.
„ 16	0·10	Snow.
„ 17	0·06	Snow (hard frost).
„ 18	0·03	„ „
„ 19	0·09	„ „
„ 20	0·23	Rain (thaw set in).
„ 21	0·33	Rain.
Total fall in 8 days	1·24	—

For details of the meteorology for the first five months of the present year, I am indebted to the Rev. H. Ffolkes, of Hillington Rectory (six miles east of King's Lynn), who has been so good as to supply the tabular statement appended to this report.*

With reference to the thaw which set in on February 20th, it has to be noted that nearly all of the 1·24 inches of rainfall above referred to would be running off the land into the river during the next few days; for, owing to the previous hard frost, the ground surface must needs for a while have remained hard and impervious. This being the case, a considerable quantity of surface water, carrying with it the various impurities lodged in or on the X's garden, must have passed at this time directly into the Gaywood River, and so to the Lynn water supply. Moreover, the rain and melting snow, in passing down the sloping path of the X's garden, would enter the pit or trench in which the typhoid excrement had been placed, and overflowing again therefrom, would carry with it the specific poison to the river, the hard and trodden path furnishing an easy channel down which the polluted water could quickly flow.

* Not here reproduced.

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On an Outbreak of Typhoid Fever in King's Lynn; by Dr. Low.

The thaw, be it noted, was in full swing on February 21st, and the outbreak of diarrhœa in King's Lynn burst forth on February 27th and succeeding days; to be followed later on, but within a fortnight of 20th February, by multiple occurrence of enteric fever among the diarrhœa patients and in other persons. The facts, therefore, are altogether consistent with the thaw having determined the occasion of general specific fouling of the Lynn public water supply, to which must be referred both the diarrhœa outburst and the typhoid fever prevalence that supervened on this diarrhœa. But having regard to the numerous sources whence foul matters could, under the circumstances of the thaw, suddenly and in abundance find their way into the Gaywood River, and thence to the town water service, it is not possible to designate any single such source as mainly at fault in the present instance.

The dangerous condition of the King's Lynn borough water supply has been, time after time, pointed out by the Medical Officer of Health and by others. The Urban Sanitary Authority has more than once proposed to protect the water by piping it from a spring or springs, but this project has always hitherto been defeated by a section of the ratepayers who, ignorant of the dangers arising from the pollution of potable water by filth, regard the present supply as all that can be desired.*

The Sanitary Authority have, I understand, under favourable consideration a scheme for obtaining a pure water supply for the town.

I also append a copy of analysis, made by Dr. Percy F. Frankland, of two samples of water, one from the intake of the present supply and the other from one of the springs proposed to be used for the new supply. The samples were taken for analysis in fine weather. Later on a third sample was taken from the intake 24 hours after heavy rain, and sent for analysis to Dr. Frankland, whose report upon it, dated July 12th, is also appended.

It may be necessary to add a word in reference to the defects in the sewers. These defects are already well known to the Sanitary Authority, and should be remedied with as little delay as possible. Meanwhile free ventilation and frequent flushing of the sewers may lessen the dangers which now exist. In some parts of the town the diarrhœal dejections of fever patients were poured down gullies in yards, and there can be no doubt that drains and sewers have become contaminated

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* Mr. W. Whitaker, F.R.S., of H.M. Geological Survey, in a presidential address to the Norwich Geological Society, delivered as far back as November 6, 1883, and published in the "Geological Magazine" of January 1884, drew attention to the Lynn water supply while discussing certain points in connexion with drinking water derived from chalk springs piped to certain towns in Norfolk, as follows:—

"The enterprise of Wisbech is thus in strong contrast to the apathy, and one may say the stupidity, of the larger town, in which I have the misfortune to live, its Norfolk rival, Lynn, the Corporation of which treat the inhabitants to one of the worst supplies that I know of. These guardians of the public health allow a set of chalk springs, some pure, but others contaminated, to mix together and to flow along an open channel of six miles or so, as the crow flies, receiving on the way the drainage of a fair tract of country, and at the last, close by the borough boundary, some part of the sewage of the village of Gaywood. Notwithstanding that the evil of this course has been pointed out for years, and constant complaints occur, yet our town councillors, in the multitude of whom there is not wisdom, have not yet made up their minds to any decided action, and a question that really admits of no debate is the subject of apparently endless discussion. 'Words, not deeds,' should be the town motto, at least as far as regards the water supply."

"Since the above paragraph was written the town council of Lynn adopted a scheme for the supply of good water, but I fear in a half-hearted way; at all events, their scheme has been rejected at a meeting of the ratepayers, and I am therefore compelled to transfer the charges above made from the members of the town council to the body of the townsmen, who seem not to be educated up to pure water pitch! When they have had a serious epidemic perhaps they may acquire more sensible views on this matter."

rith the fever poison, which, under certain seasonal conditions, may cquire renewed activity for evil.

Until a pure supply of drinking water is obtained, I strongly advise hat Mr. Wilson's recommendation to boil the water should be strictly ollowed.

ADDENDUM.

King's Lynn Water Supply.

University College, Dundee,
June 17, 1892.

)EAR SIR,

HEREWITH I enclose the results of analysis of the two samples f water sent by you and contained in two blue and two white bottles espectively.

The sample from the stream at the intake of the present supply, lthough palatable, was turbid, but contained for surface water only a omparatively small amount of organic matter. Both the ammonia and lbuminoid ammonia, however, point to the fact that some of this organic natter may be of animal origin, and from your description of the sur-oundings of the stream it is obvious that the latter must be subject to ontamination with animal refuse, more especially after heavy rains. The drawbacks of such a supply are sufficiently apparent.

The sample from the chalk springs was clear, palatable, and contained the merest trace of organic matter. It was entirely free from ammonia and albuminoid ammonia, whilst the mineral nitrogen which it exhibits in the form of nitrates is in no way excessive for spring water. This is a first class water for drinking, and although its hardness is somewhat greater than that of the other sample, it is not excessive. The hardness is just about the same as that of the supply to London from the Thames and Lee and considerably less hard than that from the deep wells in the chalk as supplied by the Kent Company. The hardness could be reduced to nearly one-fourth of its present amount by treatment with lime, as is done by some water companies.

I am, &c.

E. J. Silcock, Esq., A.M.I.C.E.,
Borough Surveyor, &c.,
King's Lynn.

(Signed) PERCY F. FRANKLAND.

Results of Analysis expressed in parts per 100,000.

Number of sample.	Description.	Solid Total Matter.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Hardness. Temporary.	Permanent.	Total.	Remarks.
	King's Lynn Water Supply.											
1.	Sample from stream at intake of present supply (blue bottles).	24·80	·200	·019	·006	·294	318	1·1	9·4	6·3	15·7	Turbid, palatable, no poisonous metals.
		Albuminoid ammonia = ·010										
2.	Sample from springs in chalk (white bottles).	29·20	·031	·009	0	·599	·608	1·15	15·3	5·3	20·6	Clear, palatable, one bottle contained ·12 part lead, the other was free from poisonous metals.
		Albuminoid ammonia = 0										

The small quantity of lead found in one of the bottles of spring water is perhaps due to this bottle having previously contained some lead salt; it cannot have been originally present in the water, as the other bottle was quite free.

P. F. F.

App A. No. 8.

On an Outbreak of Typhoid Fever in King's Lynn; by Dr. Low.

King's Lynn Water Supply.

University College, Dundee,
July 12, 1892.

Dear Sir,

I enclose herewith the results of analysis of the third sample of water sent by you from King's Lynn, and which was received by me on the 5th instant.

This sample, although palatable, is very turbid, and contains a large amount of organic matter, which, from the high proportion of albuminoid ammonia, is doubtless to a considerable extent of animal origin.

The organic matter and albuminoid ammonia are more than twice as great as in the previous sample from the same source, thus clearly showing how the stream in question is liable to excessive pollution during heavy rain.

With regard to the remark in your letter of the 23rd ultimo, I should point out that the nitrogen as nitrates (·599 part per 100,000) in the sample from the chalk springs is by no means excessive for spring water, although of course it would be large for surface water. In the case of a spring water such as this it need excite no suspicion whatever.

Faithfully yours,

E. J. Silcock, Esq., A.M.I.C.E. (Signed) Percy F. Frankland.

Results of Analysis expressed in parts per 100,000.

Number of Sample.	Description.	Total Solid Matters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Hardness. Temporary.	Hardness. Permanent.	Hardness. Total.	Remarks.
	King's Lynn Water Supply.											
No. 3.	From intake of present waterworks 24 hours after heavy rain.	28·80	·430	·051	·003	·159	·212	1·95	9·1	7·4	16·5	Very turbid, palatable, no poisonous metals.
		Albuminoid ammonia = ·025.										

No. 9.

Report on an Outbreak of Typhus Fever in the Wigan and Ince-in-Makerfield Urban Sanitary Districts; by Dr. S. Monckton Copeman.

It having come to the knowledge of the Board, through the Quarterly Return of the Registrar-General, that at Wigan an epidemic of typhus fever had broken out which had been the cause of several deaths during the last quarter of 1891, an inquiry was ordered into the circumstances of the outbreak, and I was directed to make it.

Wigan Urban Sanitary District is an iron, brass, and cotton manufacturing town in Lancashire of about 50,000 inhabitants, in an important coal district, several collieries being located actually in the town itself.

On arriving at Wigan I at once put myself in communication with the officers of the Sanitary Authority, and soon learned that up to the date of my visit above 70 cases of typhus had occurred in the town and neighbourhood, and that 10 of them had proved fatal. Also I learned that the outbreak of fever had been almost entirely confined to a portion of the town called Scholes, situated in the St. Patrick's Ward. Accordingly I visited this neighbourhood, with the object of making a thorough inquiry into the sanitary conditions of the affected area. And here I found that the knowledge of the Inspector of Nuisances (Mr. Sumner) was of great value to me, this officer being fully acquainted with the local circumstances of the various districts under his charge.

In St. Patrick's Ward, which is not inaptly named seeing that the greater number of the inhabitants are of Irish extraction, are to be found the worst slums in Wigan; this portion of the town containing a number of courts, the houses in which, as will be seen from the accompanying plan, are in many instances built "back-to-back." Houses of this class each contain for the most part three small rooms; a single room on the ground floor, opening directly to the court or street, used as kitchen, living, and sleeping room, and other two sleeping rooms, on the floor above, communicating with one another. Owing to the method of their construction (back-to-back), the only means of securing ventilation for many houses is by means of a window (generally securely fastened up) in each room, and by the street door of the lower room. At the same time the floor and cubic space of the living room are considerably encroached upon by a large bed, often of the four-poster type, which accommodates several members of the family at night. Furniture of other kinds, however, for the most part there is none, beyond, perhaps, a small table and a broken chair. Not infrequently there is an additional room below the level of the street, at one time used for a weaver's loom, which being no longer put to this purpose, is time after time made a convenient receptacle for the disposal of cinders and other household refuse, such as potato peelings, cast into it through the aperture which was once a window. The fact that many families in Wigan are living over heaps of decomposing material of this description, containing, as it does, a large percentage of organic matter, may be of importance as increasing their susceptibility to disease.

The number of persons inhabiting such a house as I have described not infrequently amounted to eight, ten, or even more individuals of both sexes, often including one or more adult male lodgers, who, I was informed, not infrequently, though in receipt of good wages, live on for years with the same family. Owing to the number of persons living in each house, the sexes are mingled in the most promiscuous

manner. The houses, both inside and out, are conspicuous for filth and squalor, and it appears that some of these places are made use of as brothels by the very lowest class of persons, a state of things which is only partially prevented by frequent nocturnal visits by the police. The bedding, so called, often swarms with vermin, so that in several instances in which during the outbreak under investigation it has been removed for purposes of disinfection, it was found to be in so filthy and dilapidated a condition as to necessitate its immediate and entire destruction.

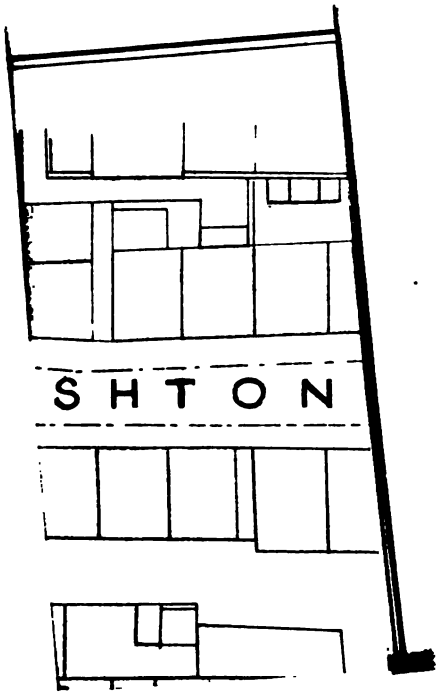
A few houses in the neighbourhood to which I particularly refer were, I found, uninhabited, probably owing to the fact that in several instances the windows and floors had practically disappeared. In one or two instances I found the remains of the floor strewn with human excrement.

The sanitary committee have made some attempts to improve the state of things prevailing in this part of the town, but their efforts have in great measure been rendered futile by the incorrigible habits of the people. Thus, owners have been required to supply doors fitted with locks to the privies, a block of which separated from the houses, as seen on the plan, are provided for the use of the inhabitants of each court or alley, the occupier of a house being supposed to be held responsible for the due cleanliness of the particular closet of which he has the key. These closets are provided with metal pails beneath the seat, which are periodically emptied by the town scavengers. As a matter of fact, however, I found in certain instances that the door had been broken down and sometimes altogether removed, having probably, as I was informed, been chopped up for firewood. In other cases, the pails had disappeared, having been found useful as wash-tubs, while the condition of the actual closet was often foul in the extreme; the whole space, not only beneath, but also in front of, and above the seat, being fouled with a mass of excreta, the more fluid portion of which formed pools on the floor, or even in the yard outside. Usually speaking, provision for the disposal of ashes and other household refuse has been made by placing tubs in a covered space between the backs of two adjoining lines of privies, but the usual result, as I found it, is that the one or two tubs nearest at hand having become filled to overflowing, refuse is afterwards simply shot into the entrance to the space containing the tubs or on the ground outside, the tubs at the further end of the space remaining empty.

Some of the yards are altogether unpaved, though in certain cases this defect has been partially amended quite recently in consequence of the action of the sanitary authority. Where this has not been done, the surface is often extremely uneven, the hollows becoming the site of stagnant pools of slop water. Such unevenness was, in many instances at any rate, due, as I proved by the use of a spade, to the presence of masses of house refuse which extended in some cases to the depth of a foot or more from the surface.

Of late, a number of houses in these courts have been condemned as unfit for human habitation; but for the most part they have not been pulled down as yet, there appearing to be some difficulty in the provision of suitable accommodation for the inhabitants elsewhere.

It will, I think, be obvious from what has been said, that the particular portion of the town to which my visit of inspection was especially directed, provided every facility for the spread of infectious disease, when once it was introduced among the people living there; indeed, it is a matter rather of wonder that they should ever be long free from illness of the zymotic type.


SHTON

I next directed my attention to the circumstances of the outbreak itself, and as a first step obtained from the Medical Officer of Health (Dr. Barnish) a list of all the typhus cases that had occurred up to the time of my arrival on the spot, together with particulars as to their sex, age, date of attack, and address. From this I found that so far there had been apparently 78 cases of the disease in 48 families,* with 10 deaths, and further, as I have already stated, that the majority of the cases occurred in a part of the town in St. Patrick's Ward, known as Scholes.

Month by month from the commencement of the typhus, the family invasions, the attacks, and the deaths in Wigan were as follows:—

Month.	Families invaded by Typhus.	Persons newly attacked.	Deaths from Typhus.
1891.—August	1	1	—
September	5	13	1
October	10	19	2
November	16	22	4
December	9	15	3
1892.—January	4	7	—
February	1	1	—
March	2	3	—
April	—	—	—

And the ages at attack and at death were:—

Age Period.	No. of Attacks.	No. of Deaths.
0–10	19	1
10–20	30	1
20–30	16	5
30 +	16	3

The first official intimation of this outbreak of fever was received on September 24, 1891, while no less than nine cases found to be typhus were removed to the sanatorium during the next two days from a house in John Street, and from one in Vauxhall Road. As all these persons had a short time previously been living together at 27, John Street, it was obvious that they must have become infected from a common source. On due inquiry being instituted by the Sanitary Authority's officers it appeared that a boy aged 16 (Edward Woosey) had been seriously ill in a back-to-back house at 27, John Street a week or two previously; and on looking through the notification records it was found that this case had been certified as one of pneumonia† on September 2nd, on which day he was received into the sanatorium. He had been first seen by a medical man on August 28th, at which time he was said to have been ill for rather more than a week; and from this date until September 2nd

* In several instances an invaded house contained more than one invaded family.

† At Wigan pneumonia has been regarded as a notifiable disease.

he was treated at home. Later on it became obvious that his pr disease had been in reality typhus.

Thereafter every single household invasion, with one exception,* traceable directly or indirectly to the Woosey family, as is illustr chronologically in the following table of the descent of the infec household by household, and as will be found set out in detail in addendum, where are given abstracts of the records of the health o and an additional chart showing the inter-relation of the several case

Fortunately for the town compulsory notification of infectious dise of inf had been in operation since 1888, and in consequence the officials of sanitary authority received information of each case of the fever almo as soon as it occurred. Affected houses were at once visited, a patients removed to the sanatorium, where they could be effectual isolated. This building, which has recently been erected and which situate about 1½ miles outside the town, consists of an administrativ block and two completely separate pavilions, each containing severa separate wards. These three blocks stand in about three acres of ground, at one corner of which is a smaller block containing laundry, mortuary, and other outbuildings. During the recent epidemic, when it appeared that the accommodation was likely to be tested somewhat severely, an iron pavilion, containing two wards, with nurse's room and kitchen, was also erected, so that it is now possible, if necessary, to deal with several different diseases, cases of each of which would be completely isolated from the others. It should here be mentioned that there had been a considerable amount of local opposition to the cost of erection and maintenance of this sanatorium, and party feeling ran so high just previous to my visit that the chairman of the sanitary committee (Mr. Phillips), a warm advocate for possession by the town of adequate accommodation for the isolation of infectious diseases, had been burnt in effigy in the market place. I learnt, moreover, that the building has been commonly known as "Phillips' Folly." On paying a visit to the sanatorium, I found that it was in charge of a man and his wife, seemingly excellent nurses and kind and attentive to the patients under them; they have a staff of nurses varying in number with the needs of the place. Both buildings and grounds appeared to be in good order; the wards are kept warm yet sufficiently ventilated. I may add that the plans for the hospital were submitted to the Board previous to its erection, and that the sanitary and other arrangements appeared to me to leave little to be desired.

Before leaving Wigan I was requested to meet the sanitary committee of the Town Council, in order to lay before them the results of my investigation into the circumstances of the epidemic, and to make any suggestions as to the precautions necessary to be observed in the future. To this request I acceded; and the more readily on account of my desire to bear testimony to the value of the sanatorium, but for the possession of which I felt very strongly that the town would have suffered from the effects of the epidemic much more severely than under existing circumstances had been the case.

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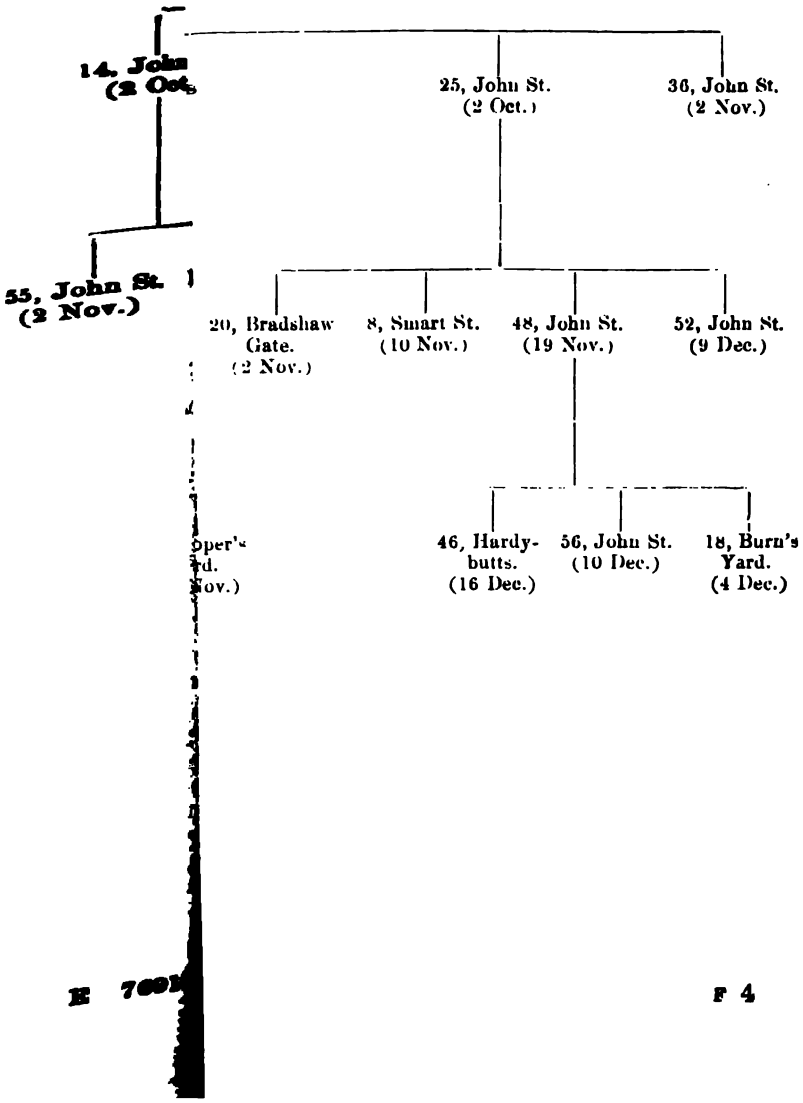
* The exception referred to is the Lennon family, residing at 49, Clayton Street. From this house two children, Bridget Lennon aged 9, and Ann Lennon aged 4, were removed to the sanatorium on December 4th and January 2nd respectively. I was informed that they had only recently come with their parents from Cardiff, and that as far as was known they had not come in contact with any previous case of the disease in Wigan.

of infection in each instance.



I accordingly met the committee at a late stage of my inquiry, on March 17th, and after congratulating them on the manner in which the outbreak had been restrained within comparatively narrow limits, I called their attention to the existence in the town, in a very marked degree, of certain factors which tend to predispose to the invasion by disease like typhus. I referred particularly to the great amount of overcrowding which prevailed in that part of the town called Scholes, and also to the fact that since a large number of houses in this area are built back-to-back, it has been impossible to secure anything like efficient ventilation of them. In addition, I pointed out that dirt and destitution appeared in this district to be all but universal. Referring also to the fact that in the first house attacked no less than 11 cases had occurred, I stated that in my opinion the reason that the outbreak did not afterwards spread in anything like a similar rate was twofold. Firstly, that efficient provision had been made beforehand for isolation of cases of infectious disease, and secondly, that such provision was promptly made use of by the removal to the sanatorium of every case as soon as it was notified. I further called attention to the fact that, although the disease had, at that time, apparently been stamped out, vigilance was not to be relaxed, as it was possible that the disease might yet break out afresh, particularly in the autumn, at which time it is specially liable to occur.

There remains to be noticed the question of the source of infection of the first case in the Wigan Urban Sanitary District, the nature and source of other continued fever occurring about the same time in other parts of the Registration District, and certain clinical considerations arising in connexion with the typhus prevalence witnessed.

Source of the Wigan Typhus.

Inquiry as to the movements of the boy Edward Woosey prior to the date of his attack elicited the information that he had never done any work since leaving school. I learnt also that he was in the habit of spending a good deal of his time at the canal wharf at Ince, which is a short distance only from the part of Wigan in which John Street is situated. The possibility, therefore, arose of his having come in contact with a previous case of typhus on one of the canal boats, or even of his having taken a trip on one of them to Liverpool, where this disease is known to be more or less endemic. As it appeared at this time quite unlikely that he could have contracted the disease in Wigan itself where no previous case had been known to have occurred for more than 20 years, I thought it advisable to follow up the suggestion thus afforded, and with this object in view I paid a visit to Liverpool.

Arrived there, I met, by appointment, the Medical Officer of Health, Dr. Stopford Taylor, who afforded me all the information in his power. On referring to the monthly records of zymotic disease in Liverpool, we found that the number of cases of typhus notified during the year 1891, up to the time of its first appearance at Wigan, was as follows:—

Cases of Typhus Notified in Liverpool.

1891.—January	6.	1891.—June	5.
„ February	17.	„ July	18.
„ March	21.	„ *August*	34.
„ April	11.	„ September	22.
„ May	3.		

The largest number in any one month had, as is thus seen, appeared in August, particularly in the first fortnight of that month, just prior to the occurrence of the first case of the series in Wigan.

Dr. Taylor also supplied me with a map of the city, on which was shown the locality where each case of typhus had occurred during the period of June 1st, August 31st, 1891. Of the whole number notified during that time no less than 18 had broken out in a court off Warwick Street, in Toxteth Park, Liverpool. On making inquiry as to whether this disease had appeared on any of the canal boats I learnt that such had not been the case. Typhus had, however, we found from the records, appeared in a house close to the canal terminus, the patient in this instance being the daughter of one of the sanitary inspectors, whose duty was to remove cases of disease from infected houses. Notification of this girl's attack was received on July 28th 1891, when she was immediately removed to the isolation hospital. Further, Dr. Taylor advised me to make inquiries at Bootle and Ormskirk as to whether there had been any recent cases of typhus at either of these places, through both of which the canal runs between Liverpool and Wigan. He also informed me that there had been a death from this disease at Bootle during the third quarter of 1891, and that therefore there might possibly have been several non-fatal cases also.

I paid a visit, therefore, to Bootle, where I called on the Medical Officer of Health, Dr. Sprakeling, but, unfortunately, failed to see him. He, however, was good enough to write to me later on, when he stated that Dr. Taylor had been mistaken as to a death having occurred there from typhus, as there had been no case of the disease in his district for some considerable time past. Having to return at once to Wigan, I did not visit Ormskirk on this occasion; nor, indeed, did I do so at all, such a course subsequently appearing to be unnecessary.

For on reaching Wigan once more, I learnt from the Inspector of Nuisances that the police had afforded some information which threw valuable light on the manner in which young Woosey had probably contracted infection. It appeared, from their evidence, that about the middle of August a navvy, whose name was unknown, had come from Liverpool to work on the railway at Wigan, and that he had lodged at 27, John Street, with the Wooseys. It was stated also that he was not well when he arrived, and that he became progressively worse during the next week, when, although very ill, he left with the intention of returning to Liverpool if possible. During his stay in John Street he slept with young Woosey, who was also in his company to a greater extent than other members of the family. Up to the time of writing, I have unfortunately failed in the attempt to trace the further movements or learn more as to the history of this man, who was in all probability the primary cause of the outbreak of typhus in Wigan.

Other Fever in the Registration District of Wigan.

At an early period of my inquiry I heard that there had been one or more cases of typhus at Ince-in-Makerfield, an adjoining township and practically a suburb of Wigan. By certain persons it was thought possible that typhus infection might have been introduced to Wigan from this quarter, but further inquiry sufficed to show that although in one sense this was true, yet in the first instance infection had apparently spread from Wigan to Ince and not *vice versâ*. The facts, as I obtained them with the help of Mr. Hall, the Medical Officer of Health for the Ince Urban Sanitary District, and other persons, were as follows:—A woman named Bridget Taylor, aged 51, had been living with her two daughters, Kate aged 20, and Alice aged 18, at 9, Victoria Street, Ince. Somewhere about the 20th January 1892, the mother was taken ill of

ras called "fever" and afterwards died on 1st February, but it ɔt possible to find out the nature of the disease which had brought the fatal termination. On January 27th or 28th the two daughters also found to be ill and removed to the local isolation hospital, typhoid fever was diagnosed; but apparently their temperatures not taken regularly, and I was therefore unable to gain confirmation :h diagnosis from temperature charts. Very shortly after these rls were taken ill, John Taylor, aged 21, a cousin of theirs, who ɛen lodging with them, went away to Wigan and took up his abode , Leader Street. On February 5th he was found to be suffering yphus, of which there had been no previous cases in Leader Street, ras removed to the sanatorium, It is, therefore, perhaps a fair nce that the disease, which had previously attacked his cousins unt, was also in reality typhus. Later on, it transpired that there een another woman in the house occupied by these people at Ince week or so prior to the date of their attack. This woman, by Marsella Lawless, had been lodging previously at 28, John Street, ı, but about Christmas she went over to Ince with the intention ng for a time with a son of hers, but he, for some reason or other, d to take her in. She therefore took up her abode with the rs, and five days after doing so was taken very ill, when she was ed by a Dr. Parker for "bronchitis." Although there had not ap-ly been a case of typhus at 28, John Street, the disease had existed ny other houses in that street for some time before she left, and quently it is by no means improbable that she, too, suffered from an of what was in reality that disease, as it is very difficult on any hypothesis than by infection through this woman to explain the quent illness of the Taylors, more especially the undoubted attack hus in their cousin.

ɔther reputed Ince case occurred in the person of Elizabeth well, who was removed from the Wigan Union Workhouse to the ɔrium in consequence of an attack of typhus on March 4th, 1892. ad, at date of attack, been for several months an inmate of the ouse. At Christmas last she had indeed discharged herself for a ɔ of days, and had visited Ince in the interval, but having regard ɔ customary incubation period of the disease, the possibility of aving contracted infection during the brief period for which she e house may certainly be dismissed. I therefore carefully searched isitors' book, and also the admission book, to see whether she have come in contact at the workhouse with some person from any e affected neighbourhoods between the date at which she last ɛd the house and that at which she was found to be suffering from ıs. I also questioned the officials as to what work she had been ; in reply to which I was informed that she washed the clothes and of patients in the workhouse infirmary. After much futile y I found that among other patients for whom she had washed man named John Doherty, who was admitted to the infirmary on ıry 30th, 1892, said to be suffering from pneumonia, and who died ɛ following day. It appeared that he had been ailing for four days, ırther, that he had come from a house in Caldwell's Fold (No. 1), ich he had been lodging for some time. Cases of typhus had been ɛd from this house on December 3rd, and December 6th previously, from the same house, also, two children aged ten years and seven respectively had been taken to the sanatorium, the disease notified in cases being "continued fever." Dr. Barnish, however, informed me here could be little doubt that these were really cases of typhus also.

It may here be stated that subsequent to Halliwell's removal to the sanatorium, no further case of the disease has broken out in the workhouse.

While at Ince for the purpose of investigating the nature of the "fever" from which the two girls named Taylor had suffered, as already described, I thought it desirable to pay a visit of inspection to the local isolation hospital in which, as I was informed, they had been treated.

The hospital is situated in the midst of a large space of waste land known as Amberswood Common, about a mile from Ince. Isolation is thus effectually obtained, but the situation has its disadvantages, since in bad weather the place is exceedingly difficult of approach owing to the practical absence of roads to it. At the time of my visit snow was on the ground, and, as a start was made from Ince, I heard strict injunctions given to the driver to keep in the direction of the track, lest our vehicle should be overturned. Arrived at the hospital, I found it in charge of an elderly woman and her daughter. The former was apparently deaf and also confined to her chair with rheumatism, while the latter attended to the household duties. Neither of them, as far as I could learn, had had any experience of nursing previous to their appointment. There were no patients under treatment at the time of my visit.

The hospital was built, as I was informed by the clerk to the local board, about 10 years ago. About three years previously, Dr. Parsons, in a report on the general sanitary condition of Ince-in Makerfield (1879), had made, among others, the following recommendation:— "Some provision should be made for the isolation of infectious disease. "This should not be delayed until another epidemic has actually "broken out, as the chief use of such accommodation is to isolate the "first cases of disease, and thus prevent it from gaining a footing in "the district." In consequence of this recommendation it was, after some time, determined to build an isolation hospital on the site I have described, so as nominally to provide for the needs of the district in this respect; but since it was also decided, as the clerk informed me, to cut down the cost to the lowest possible limit, the result can hardly be described as satisfactory.

The greater part of the hospital building consists of two wards, built "back-to-back," which communicate at one end with what may be called the administrative portion of the block. Built on to the opposite extremities of the wards are two closets with pent-house roofs. To each of these light is admitted by a small aperture about 5 inches square in the roof. Cross ventilation of the closets is said to be provided for by the insertion of perforated bricks on opposite sides near the roof. The wards are whitewashed internally; the windows and fireplaces are small and ventilation is imperfect. There was also at the time of my visit a considerable accumulation of dust and filth on the top of a wooden lobby by which the ward is entered from the other rooms. The kitchen is used as a living room by the caretaker and her daughter, while what is called the "waiting-room" is utilised as an extra bedroom.

A few yards from the hospital is a small brick building, half of which is used as a wash-house, while the other half is termed the mortuary. This latter I was unable to inspect as the key had apparently been lost.

It remains to be noted that while at Wigan I made inquiries, in accordance with instructions, as to the occurrence of "fever" in other sub-divisions of the Wigan Registration District, visiting some of them in person. Although in one or two sanitary districts cases of so-called

nued fever" had been notified, in no instance, other than those to I have already drawn attention, could I obtain evidence that any patients in question had suffered from unsuspected typhus fever.

Clinical Considerations.

ng to the fact that there is no resident Medical Officer at the Sanatorium, the records of the progress of cases treated there are lly somewhat imperfect, except as regards the temperature, which n regularly every morning and evening. Record of the state of wels, pulse, and respiration was also made, but with less regu-

In the present case the temperature charts, some of which will nd appended to this report, are particularly valuable as giving mation of the diagnosis which had been arrived at as to the nature epidemic at present under consideration. And inasmuch as some nurses themselves were attacked by the malady, the opportunity forded for studying the disease in this sense from its first onset.

tain points of interest connected either with the range of the rature or with other symptoms presented by the patients, may s here be considered somewhat in detail, seeing that not only is a rare disease in England at the present day, but also that certain were observed in the Wigan epidemic which possess a special fic interest by reason of their anomalous occurrence. For this eason, however, it may be well not altogether to omit mention of oms which, on the other hand, may be regarded as "typical," if only ggested above, for the purpose of removing any possible doubt he true nature of the disease under consideration.

st of the patients admitted into the sanatorium had been ill for ls varying from two to three or even more days previously, so that e time they were seen it was not always possible to obtain much nation as to the symptoms accompanying the onset of the disease. e case, however, of the sanatorium nurses who caught the infection ttack was ushered in with headache, loss of appetite, and general se, followed by pain in the region of the loins, and light-headed- while in one case there was not only suffusion but actual running the eyes. By the second or third day they felt too ill to leave beds; the body temperature having been found from the com- ement of the attack to be considerably raised; ranging from about F. on the evening of the first day to 103·5–104·5 on the ninth ng. In none of the patients did the temperature reach above 105° ot even in that which had a fatal termination. In most of the erature charts a slight remission of fever is noticeable from the o the eighth day, preceding by about a week the final crisis in those which took a favourable course. The fall of the temperature at risis of the illness usually commenced, as may be seen from the s appended, from the thirteenth to the fifteenth or sixteenth day. e of the nurses, on the other hand, it began as early as the tenth f the disease. In some instances the fall was continuous until a rmal temperature was reached; in others it was of an intermittent cter, the final fall consisting in a series of oscillations of temperature ding over, perhaps, three or four days. In those cases, on the con- , in which death occurred, either the crisis was not noticeable or the erature immediately leapt up again considerably above the normal e end of the second week of illness.

e pulse rate varied in different cases between 90 and 120 beats per te during the first week of the disease, usually increasing somewhat

in rate during the second week, and falling more or less coincidently with the temperature on the occurrence of crisis. In one of those cases which ended fatally, it will be seen from the chart that the secondary rise of temperature just previous to death was accompanied by a very considerable acceleration of the pulse rate.

None of the charts show the opposite condition of slow pulse mentioned as sometimes occurring in typhus, by Murchison, Barrallier, Kennedy, Maclagan, and others.

The respiratory movements ranged in frequency from 20 to 30 per minute during the first week among the milder cases, rising, however, to a still higher point with the onset of delirium. In the fatal case previously alluded to a respiration rate of 66 was noted towards the end.

With regard to the digestive system, the only point deserving of special mention is the state of the bowels, which, as is usually stated to be the case, were sometimes constipated, sometimes relaxed, the former condition, however, being the more frequent. The stools were noted to be for the most part dark in colour, this being specially the case when diarrhœa was present. In some few of the patients constipation in the first week of the disease was followed by profuse diarrhœa in the second, while in the others again this state of things was exactly reversed.

The rash in most instances was well marked, the petechial form being usually accompanied by the duller "mottling" which is generally described by the term "subcuticular," which, if unscientific, at any rate affords a fair idea of the appearance presented to the eye. In some of the children admitted to the sanatorium, however, the eruption was either absent or by no means typical. This was the case more particularly with a certain proportion of those who came under treatment towards the end of the outbreak. In these children there could, nevertheless, be little doubt, both from the history of their previous surroundings and from the other symptoms which presented themselves, that the disease from which they were suffering was in reality typhus. Possibly in some of these cases the eruption had disappeared prior to admission, it being often of a very evanescent character in children.

It is a matter worth noting, perhaps, that of the cases of typhus coming under medical observation at Wigan, the rash was in every instance followed by desquamation of the cuticle in the form of fine furfuraceous particles, and in one instance in flakes more resembling that which occasionally follows an attack of scarlet fever.

Desquamation was also found to occur in those of the children in whom, as stated above, no rash had been apparent. It was generally most marked over the abdomen, loins, and backs of the thighs and legs. Murchison says desquamation "is sometimes observed . . . where the skin has presented a general erythematous flush," but other authors, as far as I know, make no mention of the matter.

At my request inquiry was also made of a number of the patients as to whether they had lost either hair or nails during or after convalescence, it having occurred to me that since desquamation had apparently been universal during the epidemic under consideration, possibly other epidermal structures might have been shed as well. On looking up the literaure on this point, I find it stated, on the authority of Murchison, that most patients shed more or less of their hair during convalescence, but that he had never known an attack of typhus to have any effect upon the nails; although, on the other hand, Vogel described a white band and furrow which may appear at the lunula four or six weeks after the commencement of the disease and gradually advance to the extremity.

› affection of the nails, however, is not infrequently observed ıer diseases which greatly lower the vitality of the body. None andard text-books of the present day appear, however, to mention sible occurrence of such after effects of typhus. In the cases of nts who were sought out at their own houses the results of into these points were as follows:—

Number ined.	Hair.		Nails.	
	All lost.	Portion lost.	All shed.	Showed Band or Furrow.
71	21	9	4	9

lapse was observed in two cases out of the total number admitted anatorium, the patients being sisters, Horsfall by name, aged 13½ years respectively. The occurrence of a relapse in typhus is of rable interest, owing to the fact that such an event is of extreme One case indeed has been recorded by Sir George Buchanan as come under his observation at the London Fever Hospital, this ıe only one observed out of 18,268 cases of typhus during a of 23 years. Ebstein also met with a case in 1869. Murchison, , and Tanner all state that they had never seen an instance of a apse.

ı the temperature charts (Nos. 7–10) of the Horsfalls' illnesses ıe seen, in the case of the elder girl particularly, that the curve irst attack has perhaps rather more resemblance to that of enteric an to that of typhus, especially as convalescence was delayed in ses beyond the end of the third week. Enteric fever, however, t prevalent at the time; and Dr. Barnish assures me that the each patient was as typical on the first as on the second occasion, ıs the temperature chart at once shows, there can be no doubt as correctness of the diagnosis. In both first and second attack the irl more especially suffered from fairly profuse diarrhœa, but he stools were quite unlike the "pea-soup" variety seen in fever, being very dark in colour and resembling in all respects f undoubted typhus cases who were under treatment at the same Desquamation also was observed during convalescence on all four ns. It would appear therefore that these two girls did really rom typhus on both occasions, rare though we know such an ınce to be.

ı regard to the complications and sequelæ that were observed in ion with this outbreak of typhus at Wigan, it may be noted that delirium occurred in 11 cases, in five of which it was of so a type as to necessitate the strapping down of the patient. In cases, two of which came under my own observation, the original was complicated with pneumonia, while in "many" others true lysis came on. Phlebitis and thrombosis of the femoral vein a smart rise of temperature in one case, subsequent to the critical d in two others parotitis occurred at about a similar period. The equelæ of importance noted may be briefly tabulated as :—

Laryngitis	Two cases.
Bronchitis	,,
Pleurisy	One case.
Phthisis	,,
Neuralgia	,,

The treatment adopted consisted in the exhibition of a mixture of quinine and hydrobromic acid every four hours; effervescing mixtures in the event of persistent vomiting; and to combat hyperpyrexia, antifebrin (four to six grains occasionally), and tepid sponging. With regard to dietetic treatment, warm milk was used in every case, the quantity being only limited by the amount which it was found possible to administer. The milk was peptonized in those instances in which it disagreed in the fresh state. Stimulants were freely used, almost every case receiving from five to ten ounces of brandy per diem. Unfortunately no post-mortem examination had been made, and no bacteriological observations were possible, as at the time of my visit the cases then in the hospital were, I considered, in too late a stage of the disease to afford results likely to be of any value.

The foregoing brief clinical account of the Wigan outbreak is compiled mainly from notes, the use of which was afforded me by Dr. Barnish, the Medical Officer of Health, and by Dr. Martland, the District Medical Officer, who have both been at much trouble to obtain and supply me with detailed information on those points which I thought to be of special importance. To both these gentlemen, as well as to other officials of the sanitary authority, my best thanks are due for the valuable and unstinting help afforded me during the prosecution of this inquiry.

ADDENDUM.

The following brief history of the progress of the epidemic is mainly based on information supplied to me by Mr. John Sumner, Chief Inspector of Nuisances for the borough of Wigan. He stated that the first intimation of the epidemic received was a personal notice to himself on September 24th last, that "fever" existed at No. 27, John Street. He at once proceeded there and found that the tenant, Woosey, his wife, and two children were ill, and were being attended by the Union Medical Officer, who notified the case next morning as typhoid fever. Mr. Sumner discovered that another boy of Woosey's (Edward) had been ill for two or three weeks, but appeared at that date all right again. It was afterwards found that this case had been notified on the 2nd September as pneumonia.

On September 10th, John Hagan, of 19, John Street, a playmate of Edward Woosey's, had been notified as suffering from typhoid, and had been sent into the sanatorium the following day. Woosey's family, with the exception of Edward, had been taken ill nearly at one and the same time, and they had been ill about three or four days when the inspector first visited them.

In addition to Woosey's family, Mrs. Qualey and four or five of her children lived also at No 27, John Street. They were lodgers there, and when they found fever in the house removed to 52, Vauxhall Road. The inspector immediately informed the Medical Officer of Health of the cases at 27, John Street. He accordingly visited the house the next day (September 25th), and directed that Woosey, his wife, and their two children should be removed to the sanatorium at once.

The boy, Edward Woosey, who had been ill and recovered, went to stay with his aunt at 3, Richard's Yard, together with another brother (Peter), who had not yet been ill. The latter was afterwards attacked, and was taken to the sanatorium. When all the tenants had left Woosey's house all the bedding and the whole of the furniture, such as it was, was destroyed, and the house was thoroughly disinfected. Whilst the Wooseys were being removed to the sanatorium, the inspector received information that the Qualeys had been taken ill. He went to their new lodgings at 52, Vauxhall Road, occupied by Mrs. Cox, and found that Mrs. Qualey and her children, with the exception of one boy, were ill. He notified the fact to the Medical Officer, and on the following day, September 26th, Mrs. Qualey and the four children were taken to the sanatorium. The other boy remained with Mrs. Cox, at 52, Vauxhall Road. After the Qualeys had been transferred to the sanatorium, Mrs. Cox was induced to remove

her house for a day. Whilst she was away, No. 52 was thoroughly cted, and the bed which had been used by Mrs. Qualey was ed. After the house had been fumigated, Mrs. Cox, her family, and Qualey returned.

leptember 28th, the Medical Officer of Health received a notifica- at Mary Ann Clark of 41, Higham Street, a friend of Mrs. Woosey's, ffering from typhoid. She was removed to the sanatorium the ay, when the case was found to be one of typhus. She was a l woman, living with her husband and child, neither of whom were d. The house was disinfected the same day.

leptember 29th, Peter Woosey, who had removed from 27, John to 3, Richard's Yard, was notified as suffering from typhus, and was ed the same day to the sanatorium.

)ctober 1st, James Smalley, of 3, Actons Court, was certified to be h typhus, and was removed to the sanatorium the same day. He ı acquaintance of the Wooseys.

October 2nd, John Percy, of 14, John Street, and Bridget Tague, John Street, playmates of the young Wooseys, were removed to natorium, suffering from typhus, and on October 5th, John Hagan, John Street, father of the boy removed on September 11th, and ı and daughter (playmates of Wooseys), were also removed.

October 12, James Moore, another playmate of the Wooseys, was ed to the sanatorium. On the same day Patrick Qualey, who, he attack of the other members of his family had been living with ox at Vauxhall Road, was taken ill and also removed to hospital.

)ctober 16th, Mary Woosey (aunt of Peter Woosey, junior), and her ring in Richard's Yard, were taken ill and were removed to the rium.

)ctober 21st, Mary Clinton of 54, Vauxhall Road, to whose house ox's removed whilst 52, Vauxhall Road was being disinfected, was to the sanatorium suffering from typhus. She had been in the of visiting Mrs. Cox, who on October 22nd was certified as suffering neumonia. Mrs. Cox died shortly afterwards, and when the house, uxhall Road, was visited it was found that preparations were being for holding a wake on her body, but with the assistance of the the friends of the deceased were induced to dispense with the on.

October 26th, Mrs. Cox's daughter was removed to sanatorium ing from typhus.

October 31st, Mr. and Mrs. Tague and two children were removed 25, John Street, all affected with typhus; and on the same day t Causey, of 215, Scholes, who had previously, from the 8th mber to October 25th, been in the sanatorium with scarlet fever, aken there again suffering from typhus. No. 215, Scholes was ected and no further case occurred there.

November 2nd, William Coates, of 20, Bradshawgate, the only one amily of eight who caught the disease, was removed to the sana- n. He was a friend of the Tagues, of which family on the same day ıore were admitted to the hospital.

ry A. Howarth, who had been lodging at 55, John Street, with a hter of John Percy; a boy (Whittle), of 36, John Street; and er daughter of Catherine Cox were also all admitted on November No other member of Whittle's family caught the disease.

the 3rd November, Ann Bennett, of 55, John Street, a married sister hn Percy, was removed to the sanatorium; and the same day ge Finn, who had been lodging with Mr. John Percy at 14, John , was also moved to the sanatorium, where he died.

November 4th, Alice Poole, of 10, John Street (a friend of the s), was removed to hospital; and on the following day her mother, Gould, was also admitted to the sanatorium.

November 5th, John Moore, of 24, John Street, father of the James s previously mentioned, was removed to the sanatorium.

November 10th, Mary Halliwell, of Stuart Street, a daughter of Mrs. s, was taken *to the sanatorium*; and on the same day Rose Coleman, *Richard's Yard, who had been* attending the patients next door (at *was attacked with typhus* and sent to the sanatorium. Her son *ter were also attacked* at a later period.

On November 10th, Eliza Kelly, nurse at the sanatorium, was taken ill with typhus. Between November 14th and November 19th Bridget Cox, daughter of Mrs. Cox deceased, was removed to hospital from 52, Vauxhall Road; Ann and Thomas Moore were removed there from 24, John Street; Elizabeth Smalley, daughter of James Smalley, was removed from Acton's Court; and Mary Maley from 48, John Street (directly opposite Woosey's house).

On November 23rd, Maria and Alice Horsfall, daughters of Mrs. Horsfall of 34, Top Croft, a fish hawker, were removed to the sanatorium. Mrs. Horsfall had been very intimate with the Qualeys, but she herself was not attacked.

On the same day Catherine Diamond, of 36, Cooper's Yard, Scholes, a relative of the Wooseys, was also removed to the sanatorium.

On December 2nd, John Bennett, of 55, John Street, whose wife had previously been affected, and James Cox, who had removed from Vauxhall Road to 58, John Street, were taken to the sanatorium, where the latter died.

On December 3rd, Agnes Percy, a sister of Mrs. Finn, was removed to hospital, as was also Catherine Burns of 1, Caldwell's Fold, a sister of Rose Coleman, of 2, Richard's Yard.

On December 4th, Bridget Lennon, whose mother was lodging at 49, Clayton Street, was admitted to the sanatorium, suffering from typhus. This family was stated to have come from Cardiff, or some other place in South Wales, only a week before. The house was disinfected, but on the 8th December another sister (Anu), aged four years, was taken ill and also was removed.

On December 4th, Elizabeth Cartwright, of 13, John Street, a playmate of the Wooseys, and George Chisnall, of Burn's Yard, Vauxhall Road, who had been working with Finn and Maley, were isolated at the hospital.

On December 6th, Thomas Coleman, son of Rose Coleman, who had been living with his aunt (Catherine Burns) at Caldwell's Fold, and on December 7th and 8th, Bridget Maley, together with her daughter and husband, were all removed to hospital from 48, John Street.

On December 9th, Annie Howarth, of 52, John Street, was admitted to hospital. She appears to be no relation to the Howarths, of 55, John Street, but had been on intimate terms with several of the previous sufferers from the epidemic.

On December 10th, John Cusick, who had formerly lodged with the Maleys at 48, John Street, was removed to hospital from 56, John Street, to which house he had gone subsequent to a notice having been served for overcrowding at No. 48.

A week later Cissy McGrath, of 46, Hardybutts, who had had occasion to call at 48, John Street, was admitted to the sanatorium.

On December 28th, Catharine Nyhan, a nurse at the sanatorium, was laid up with typhus, and on the same day Elizabeth, a sister of Eliza Cartwright, was removed there.

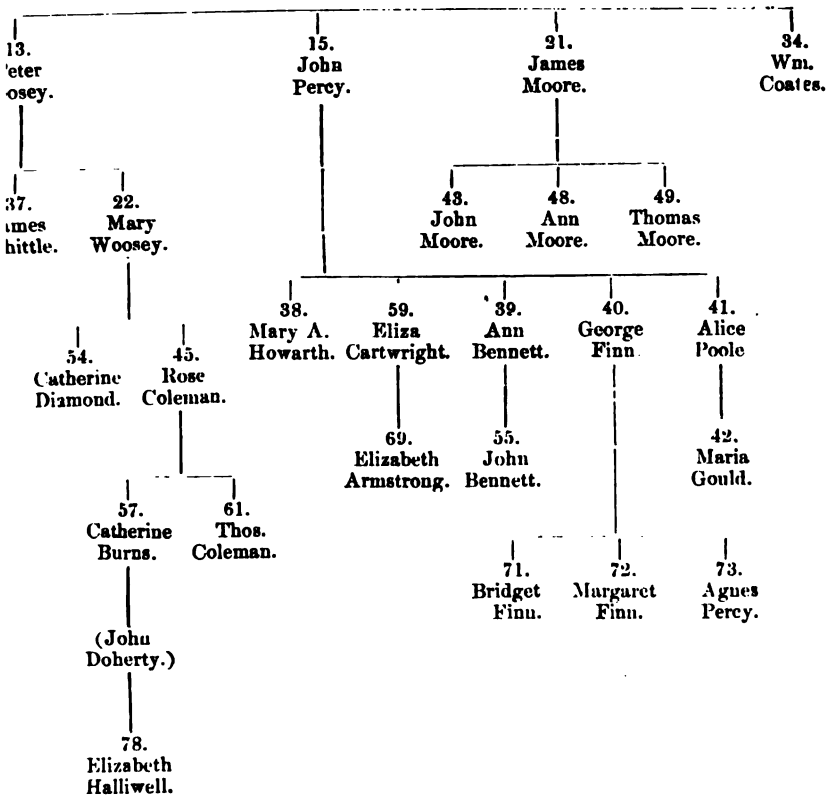
On January 2nd, 1892, Bridget and Margaret Finn, wife and child of George Finn, were removed from 14, John Street, and on January 12th, Maria and Alice Horsfall, of 34, Top Croft, were again admitted to the sanatorium for a relapse of the disease.

On February 5th, John Taylor was removed to hospital from 55, Leader Street. He had been visiting his aunt and cousins at Ince at a time when the former, who has since died, was suffering from fever.

On March 4th, Elizabeth Halliwell, who belongs to Ince, was taken to the sanatorium from the Union Workhouse, suffering from typhus.

In addition to those specially mentioned, every house in which typhus had existed was disinfected immediately on the removal of the patients, in some instances the process having had to be repeated three or four times over.

The chronological order of the cases mentioned in the preceding paragraphs and more particularly their relationship to one another as regards infection from case to case, will perhaps be more clearly understood by reference to the table in the form of a genealogical tree, which is *appended*.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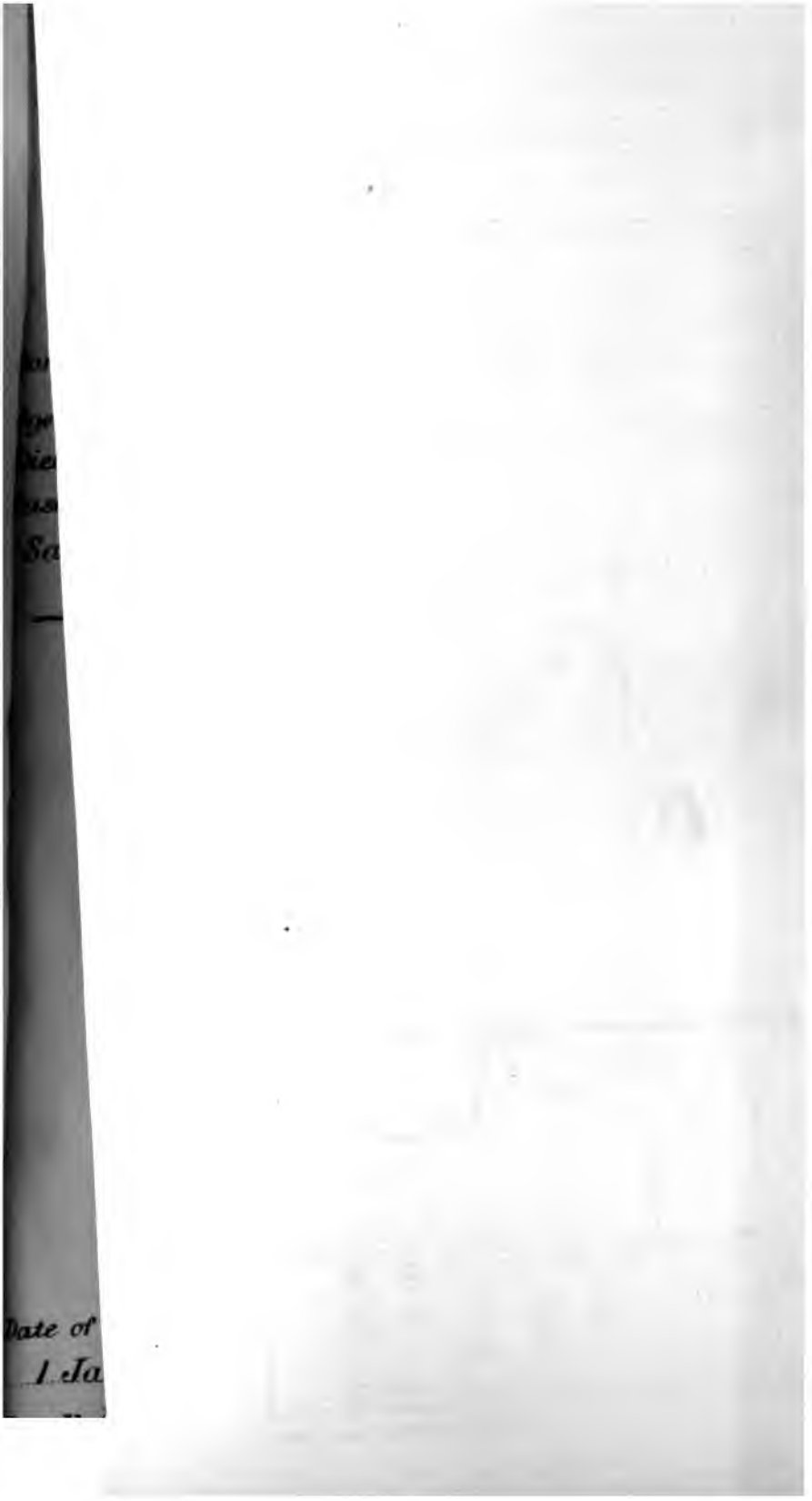
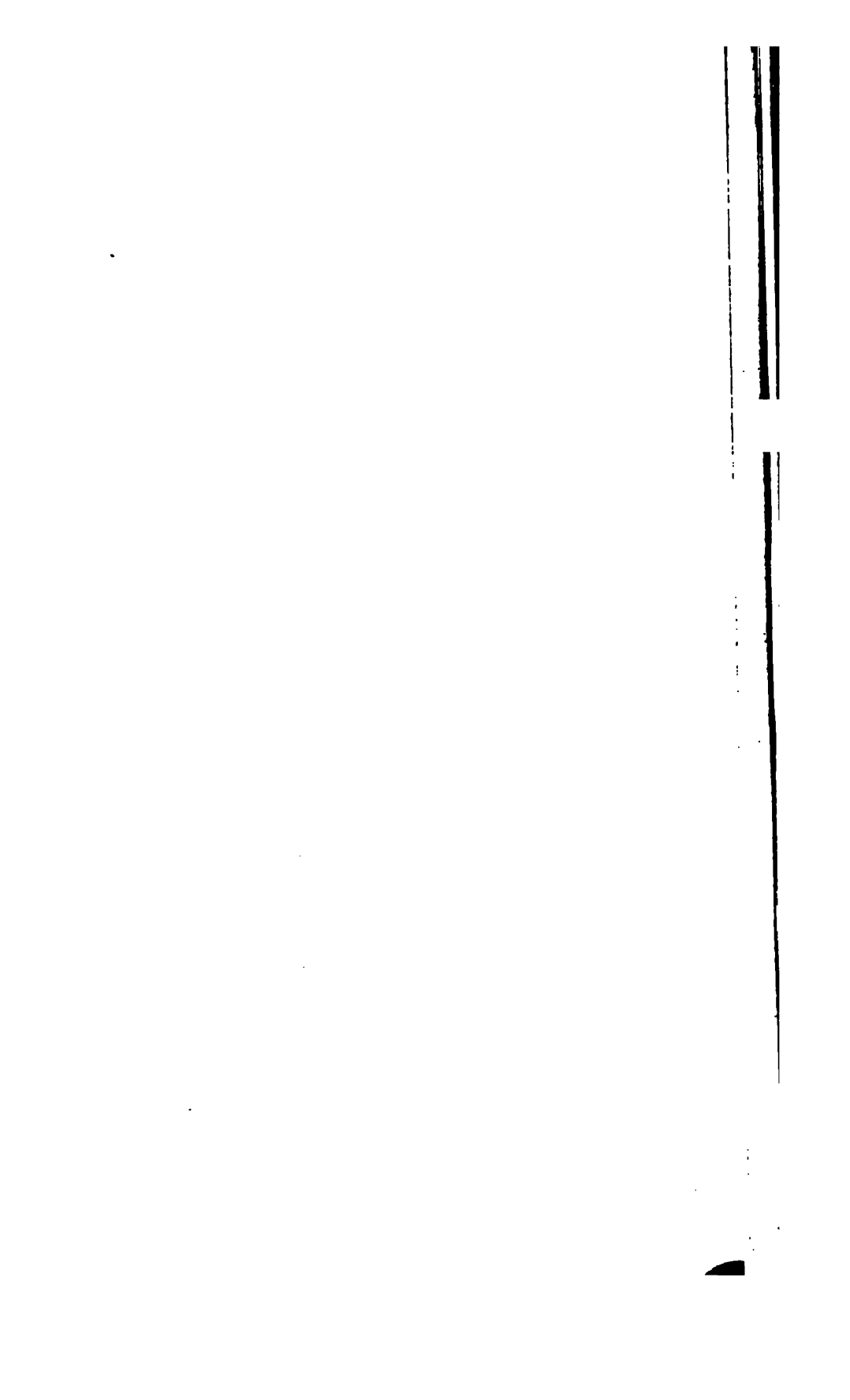
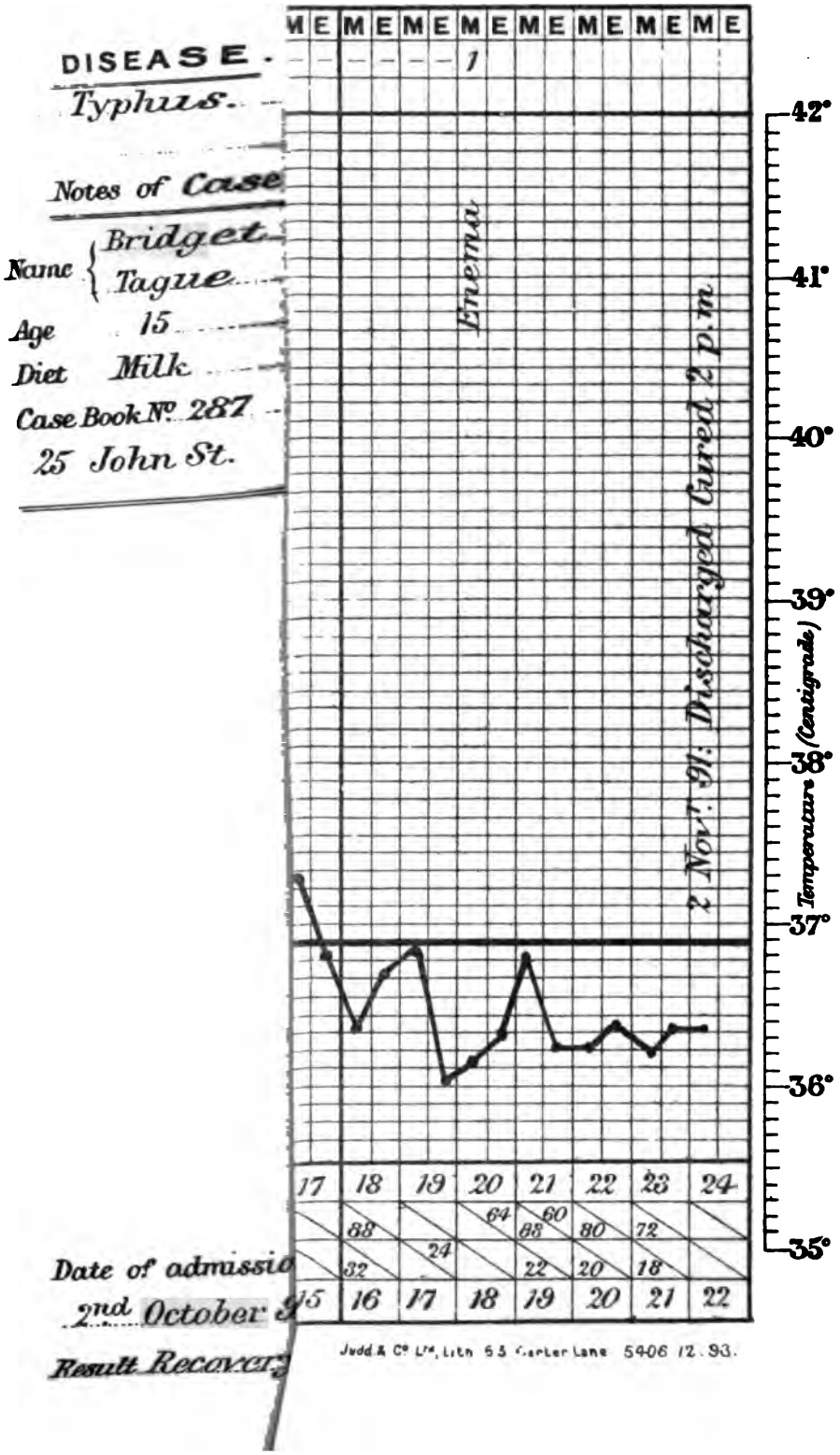
Thomas
Moore.
38.
Mary A.
Howarth.
59.
Eliza
Cartwright.
39.
Ann
Bennett.
40.
George
Finn.
41.
Alice
Poole
54.
Catherine
Diamond.
45.
Rose
Coleman.
69.
Elizabeth
Armstrong.
55.
John
Bennett.
42.
Maria
Gould.
57.
Catherine
Burns.
61.
Thos.
Coleman.
71.
Bridget
Finn.
72.
Margaret
Finn.
73.
Agnes
Percy.
(John
Doherty.)
78.
Elizabeth
Halliwell.





Case of Typhus Marked Crisis on 15th Day.



No. 10.

REPORT on the SANITARY CIRCUMSTANCES of the BROWNHILLS URBAN SANITARY DISTRICT, and upon ADMINISTRATION by the SANITARY AUTHORITY; by MR. T. W. THOMPSON.

In the month of July 1891 a representation under section 19, sub-section 2, of the Local Government (England and Wales) Act, 1888, was made by the Staffordshire County Council to the Local Government Board, to the effect that the Public Health Acts had not been properly put in force within the district of the Brownhills Local Board. This representation was accompanied by an extract from a report by the Medical Officer of Health to the County Council, upon which, apparently, the representation was based.

It should here be mentioned that, at the time of the receipt of the representation of the County Council, the Board were already in communication with the Brownhills Urban Sanitary Authority with respect to the unsatisfactory condition of their district disclosed in the annual reports for the year 1890 of that Authority's Medical Officer of Health and Inspector of Nuisances.

The Board had especially directed the attention of the Authority to certain passages in those reports indicating the defective character of water supplies, the need for sewerage extension, and the need also for improvement in the removal of refuse. With regard to the last matter, the Board had referred to a previous communication in which they had suggested that the Sanitary Authority should themselves undertake or contract for the work under section 42 of the Public Health Act of 1875.

In accordance with the usual custom in such cases, copies of the representation of the County Council and of the extract from the report of the county Medical Officer of Health were on September 15th, 1891, forwarded by the Board to the Brownhills Urban Sanitary Authority, with a request (in view of previous correspondence) that the Board might "be informed in a short time of the steps actually taken by the "Authority in regard to water supply, sewerage extension, and the "work of excrement removal in their district, especially with reference "to the matter specified in the representation." No reply having come from the Sanitary Authority, and the Board having meanwhile received from the Staffordshire County Council copy of a special report by the county Medical Officer of Health upon the sanitary condition of the Brownhills district generally, with further representation from the County Council of need for the Board's intervention, the Board upon October 2nd despatched a further letter to the Brownhills Urban Sanitary Authority pressing for the information asked for in their communication of September 15th.

Upon October 10th the following reply was received:—

"The Local Board for the Brownhills District,

"SIR, 9th October 1891.

"I BEG to acknowledge the receipt of your letters of the 15th September and 2nd October herein, which were duly laid before the Brownhills Local Board at their last meeting, and in reply thereto I am instructed to state—

"(1.) *Water Supply.*—The Local Authority are in communication with the South Staffordshire Waterworks Company upon this subject, and when any definite arrangement is made the Local Government Board will be informed thereof.

"(2.) *Sewerage Extension.*—This matter is under consideration. It is most serious question in a sparsely populated district like that of tl Brownhills Local Board.

"(3.) *Excrement Removal.*—Tenders for the removal of excrement, &c have been advertised for and received by the Local Board and have bee accepted by the Board.

"(4.) *Horobins Row.*—The Local Authority are in communication wit the Waterworks Company in reference to the extension of their mains.

"(5.) *Clayhanger Brook.*—The drainage of the property referred to now being connected with the sewer of the Local Board.

"I am, Sir,
"Your obedient servant,
"T. Howard Stanley,
"Clerk to the Board.

"The Secretary,
"Local Government Board,
"Whitehall, S.W."

As a result of the circumstances above detailed I was, upon March 19th, 1892, instructed to inspect and report upon the district in question.

In the following report will be found some description (A.) of th sanitary circumstances of the district, (B.) of the administration by th Sanitary Authority.

(A.)—Sanitary Circumstances.

General Description.—The Brownhills Urban Sanitary District situated in the Cannock, Lichfield, and Walsall Registration District and has an area of 8,772 acres. The enumerated population of tl district in 1881 was 11,059, and in 1891, 13,703. The number of i habited houses in 1881 was 2,075, and in 1891, 2,514. The Distri is bounded on the north by the Cannock Urban and Lichfield Rur Sanitary Districts, from the former of which it is separated by t Newlands brook. On the south it is bounded by the Aldridge bro and the Walsall Rural Sanitary District, on the east by the Lichfi Rural Sanitary District, and on the west by the Wash brook, whi separates it from the Cannock Rural District and the county borough Walsall.

The variations in the elevation of the district range from 422 fe above Ordnance datum at Shavers End to 590 feet at the Five Wa Norton.

The district is largely rural in character, but contains the followi groupings of population, viz.:—(*a*) Brownhills (1,022 houses);* (Walsall Wood (444 houses); (*c*) Norton Canes (367 houses); (Shelfield and High Heath (232 houses); (*e*) Clayhanger (110 house (*f*) Hammerwich (102 houses); (*g*) Triangle and Chase Road (houses).

The surface soil consists mainly of clay, which rests, in the west portion of the district upon the Coal Measures and in the eastern porti upon the Red Sandstone and Conglomerate. In places the clay is s to be capped with sand.

Dwelling Accommodation.—Out of the total 2,334 houses indica above, in connexion with one or other of the seven villages, 710 rated at less than 5*l.*, and 1,365 at above 5*l.* but less than 10*l.*†

Except in few instances where houses had in past years been b upon the back-to-back system, there was not observed any nota

* Including the Wilkin and Watling Street.

† This information was supplied by the surveyor to the Local Board.

crowding of dwellings upon area, the houses as a rule being provided with a fair amount of back space and in some cases with gardens.

A considerable number of the houses are devoid of eave spouting, and in some cases the surface drainage is deficient or defective, circumstances which conduce to the dampness of dwellings. Many yards are unpaved, and in some cases ashes were found heaped or strewed about them. In others, slop-waters were found lying in pools within short distances of the dwellings.

Where sinks are provided within the houses they usually discharge simply through a hole in the wall—the sink waters running down the outside of the wall to find their way to a channel or gully below. This arrangement obviously keeps the wall in a damp condition, and, in not a few instances, the sink-waters were found soaking down towards the foundations of the houses.

Water Supply.—Three hundred and forty-one houses within the district,* viz., 287 at Brownhills, 31 at Chase Road, and 23 at High Heath are supplied with water from the mains of the South Staffordshier Waterworks Company; but the remaining villages and houses (some 2,000 of the latter) are dependent upon wells. These wells vary in depth, but taken as a class they are of very defective construction, and are frequently surrounded by obvious sources of pollution. Internally they are simply dry steined, no attempt having been made to prevent water finding its way into them through the upper layers of the soil. In certain instances liquid, coming from the direction of middens, was observed trickling into the wells. Some of the tenants are aware of the impurity of the water of these wells, and are, in consequence, compelled to send for drinking water to other wells, which in some cases appear little less open to suspicion than those discarded. Thus, the occupiers of a row of houses at Shire Oak, whose own wells are so circumstanced as to render their contamination a natural consequence, send to the well of a neighbouring house. Within about five yards of the latter well, which is merely dry steined, there is a large hole in the ground serving for the disposal of slop-waters, and which at the time of my visit contained a considerable quantity of decomposing filth. It was significant to notice that the vegetable growth upon the steining of this well was decidedly more conspicuous upon the side nearest to the primitive cesspool in question.

Many of the wells are unprovided with any special pail for drawing the water, and consequently persons send their own pails for the purpose, a system which the Medical Officer of Health believes to have had concern with the spread of infectious disease. Some houses are entirely without any water supply of their own. Owing to this cause, as also to the suspicious character of their own supplies, the occupiers are compelled in some cases to send considerable distances for water.

In various instances in which the water-supply was found to be either deficient or of doubtful quality, I was informed, in answer to my questions, that the mains of the South Staffordshire Water Company were already within a comparatively short distance of the localities in question.

With reference to the negotiation with the Water Company referred to in the Sanitary Authority's letter of 9th October 1891, no arrangement as to the supply of Horobins Row has yet been arrived at.

Sewerage and Drainage.—The greater part of the village of Brownhills is sewered with pipe-sewers, which are said as a rule to have

* These figures were supplied by the surveyor to the Local Board.

good gradients. These sewers are ventilated by partially open manhole covers at the street level, and are stated to be flushed with the South Staffordshire water about once a month. There is a flushing tank at the head of one of the sewers, but the remainder of the sewers are flushed by filling the manholes with water and subsequently discharging it into the sewers.

The Brownhills sewage is conveyed to a sewage-farm belonging to the Local Board, the effluent ultimately finding its way into the Clayhanger brook. The farm consists of 106 acres, 65 of which are underdrained for irrigation purposes. The remaining 41 acres cannot, it appears, be reached by gravitation from the present outfall. The soil is stiffish clay in the upper part, and light peaty in the lower part. The farm is let by the Sanitary Authority, the present tenant having been in occupation since March 1891.

At the time of my visit the subsiding tanks, of which there are two, having each a capacity of 9,000 gallons, were practically full of black offensive sludge, over the surface of which sewage was trickling, to find its way into the main carrier. Some men were, however, engaged in attempting to empty the tanks, a process, I was informed, which had not been carried out during the present tenancy. One of the main underground carriers, at the date of my visit, was blocked, and as a consequence the sewage was being turned on to a limited area of a grass field at which spot the land was apparently sewage-logged.

Of sewage treatment proper there appeared no sign.

In some of the other villages, as the Wilkin and Norton, there are pipe-drains which receive the slop drainage from groups of houses. "Sewers" of this sort are unventilated, and discharge their contents into ditches. At Shelfield (Walsall Wood) some 50 houses drain into a 12-inch pipe sewer, which discharges into a small brook by the roadside. The extension of proper sewerage appeared to be much required in this district, notably at Walsall Wood, a populous and growing neighbourhood, in which it was stated there are no sewers at all at present.

Where "sewers" do not exist, the slop-waters are usually conveyed by open channels to small "catchpit" cesspools. The channels are often irregular and defective, and in some instances consist merely of shallow trenches dug in the ground. Owing to primitive arrangements of this kind, slop waters were found soaking into the soil very near the dwellings. In one case, in Friesland Lane, slop-sewage was found standing in pools quite close to the house, and ashes had been banked up against the house wall apparently with the view of soaking up the sewage and keeping it out of the house.

The catchpit cesspools are mostly bricked, but are not rendered in cement, even in the case of new houses. They are mostly covered with loose covers, generally of wood, and are often situated very near to dwellings. One was found within four feet of the house wall. In the case of a row of new houses at Walsall Wood (Coppice Road) the slop-water cesspools are placed in the little gardens in front of the houses and at a distance of about a foot only from the roadside footpath. That they must be productive of nuisance to passers by there can be no doubt; indeed the smell from them was distinctly perceptible at the time of my visit, and the Medical Officer of Health stated that he had had great complaints with respect to them.

Excrement and Refuse Disposal.—The privy midden is in general use. The middens are of excessive size, sunk, often deeply, below the ground level, and many of them are uncovered. They were mostly found in a wet and offensive condition. In some cases liquid filth

was seen percolating, above ground, through the brick sides of middens and privies. At St. James's Place, Brownhills, liquid filth, which had found its way from the privy receptacle, was standing in a pool on the privy floor, from whence it was overflowing and running down almost to the door of the nearest house.

Until November of last year the scavenging of middens was left entirely to the householders. In that month, however, as a consequence apparently of the remonstrances which had at different times been addressed to them by the Board, and of the visits of the Medical Officer to the County Council, the Sanitary Authority entered into contracts with four separate contractors for the scavenging of the four different wards in the district.

The contracts, which were made for the period of one year, require the contractors to remove all night-soil and ashpit and house refuse in accordance with the provisions of the byelaws. The contracts have certainly not been acted up to in this respect, for the byelaws require the cleansing of every ashpit and every privy "at least once in every week." So far from this having been achieved, large accumulations of ashes were in some instances found which had never yet been visited by the scavenger, and many middens, although said to have been emptied once or more under contract, were quite full at the time of my visit. The scavenging of the district must, therefore, still be regarded as unsatisfactory, and this appeared to me to be notably the case in the Central and Ogley Hay Wards.

Slaughter-Houses.—There are few slaughter-houses in the district, and such as were visited appeared to be clean and fairly well kept. As regards one, however, the blood was found thrown upon the dung heap, and another drained into a large catchpit immediately outside the slaughter-house, the overflow from the catchpit being connected with the sewer. The catchpit was said to be cleaned out once a week, but at the time of my visit it contained a quantity of water contaminated with decomposing slaughter-house washings.

There are five slaughter-houses on the register, and they are said to be inspected from time to time by the Inspector of Nuisances.

Cowsheds, Dairies, and Milkshops.—These are registered and the Sanitary Authority have adopted regulations, which came into operation on April 4, 1888, for their management. Some which were visited, however, were not particularly clean, and exhibited defects either of drainage, ventilation, or water supply. They are said to be inspected by the Inspector of Nuisances about four times a year.

There is not, it is said, any common lodging-house, and only one bakehouse in the district.

(B.)—Sanitary Administration.

The Brownhills Urban Sanitary District was constituted in the year 1877, having previously been comprised within the Cannock, Lichfield, and Walsall Rural Sanitary Districts. The Board consists of 12 members.

The Medical Officer of Health (Dr. John Coombe Maddever) was originally appointed on November 5th, 1882, and has thus held office for a period of over nine years. He is also District Medical Officer to the Cannock District of the Cannock Union, and is in private practice in the district. As Medical Officer of Health he receives a salary of

P. A. No. 10.
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40*l.* a year, half of which is repaid from the public funds. He appeared to me to be well acquainted with his district, and alive to the urgent need for improvement in its sanitary condition.

In his Annual Reports, particularly those for 1887 and 1890, he has directed the attention of the Sanitary Authority to the unsatisfactory character, both as regards quantity and quality, of the water supplied by local wells, upon which so large a number of the inhabitants are still dependent. He has also adverted to the need for extension of sewerage; for improvement in the construction of "ashpits" (middens), and the removal of refuse; for the provision of permanent isolation accommodation; for the adoption of the Infectious Disease (Notification) Act; and for the prompt institution of proceedings, when necessary, to ensure the abatement of nuisances. It will be gathered from this report, however, that as regards several of the important matters above referred to, either little or no result has attended the advice of the Medical Officer of Health.

The Inspector of Nuisances (Mr. J. H. Shaw) is also Surveyor to the Local Board. He has held office since 1887. As Inspector of Nuisances he received a salary of 75*l.* a year, half of which is repaid from the public funds. As Surveyor his annual salary is 110*l.*, this sum, however, being inclusive of 52*l.* allowed for an assistant.

Mr. Shaw is a certified inspector and appeared to be a competent officer. Year after year he has referred, in his Annual Reports, to "numerous complaints" made to him with respect to the quality of the water obtained from wells, the majority of which he describes as "shallow wells in close proximity to privy middens and pigsties."

The Sanitary Authority are not at present provided with any Infectious Diseases Hospital or disinfecting apparatus. Neither have they adopted the Infectious Disease (Notification) Act, 1889,* nor any of the clauses either of the Infectious Disease (Prevention) Act, 1890, or of the Public Health Acts Amendment Act, 1890.

They have, however, a code of byelaws, allowed by the Local Government Board on October 15th, 1879, with respect to,—

(*a.*) The cleansing of footways and pavements, the removal of house refuse, and the cleansing of earth closets, privies, ashpits, and cesspools;
(*b.*) Nuisances;
(*c.*) Common lodging-houses;
(*d.*) New streets and buildings;
(*e.*) Slaughter-houses.

The byelaws themselves are similar to those of the Model Series issued by the Board. But in several important respects they have not been enforced This is notably the case with regard to the construction of new privies, ashpits, and cesspools. Such ashpits as were visited which had been recently constructed in connexion with new houses, were found mostly of excessive size, not rendered inside with cement or asphalted, nor were their floors raised three inches above the level of the surrounding ground, as required by clause 84 of the byelaws.

As an instance may be mentioned a new ashpit belonging to some cottages recently built, and the property of a member of the Sanitary Authority. This ashpit, intended for the use of two cottages, and with

* Scarlet fever, the Medical Officer of Health informed me, is always more or less present in the district, and this he believes is largely due to the number of cases which, owing to the absence of notification, are not brought to his notice, and are not consequently subjected to proper control.

hich two privies communicated, had a capacity of 140 cubic feet (30 cubic et being the maximum allowed by the byelaws for a single ashpit), was ot cemented or asphalted internally, and its floor was sunk more than wo feet below the level of the surrounding ground.

The new catchpit cesspool* provided for the slop waters of these ottages was not cemented internally and was situated at a distance of ess than four yards from the dwelling-house, though the byelaws require hat all cesspools primarily constructed in connexion with new houses shall be at a distance of "thirty feet at the least from a dwelling-house . . . . " and shall be rendered inside with cement.

Defects of a similar character to those above mentioned were found as regards new ashpits and cesspools elsewhere, and seemingly no attempt had been made to enforce the byelaws in these important particulars.

As a result of my inspection the conclusion seems unavoidable that with respect to the provision of sufficient sewers for their district, the provision of wholesome water supplies, and the enforcement of byelaws, the Brownhills Urban Sanitary Authority have failed in the discharge of the duties imposed upon them by the Public Health Act, 1875.

In so far, too, as they have omitted to take advantage of the powers extended to them by that Act, for the purpose of enabling them to make provision for the isolation of persons suffering from infectious diseases, and for the disinfection of bedding, &c., and in so far also as they have omitted to avail themselves of the important powers further extended to them by the Infectious Disease (Notification) Act, the Infectious Disease (Prevention) Act, and the Public Health Acts Amendment Act, but one conclusion can be arrived at, namely, that they are but little mindful of their responsibilities in the matter of safeguarding the health of the inhabitants of their district.

* Capacity about 56 gallons.

App. A. No. 11.

Compilation of Returns of Notified Infectious Diseases, and registered Deaths therefrom.

No. 11.

TABLE showing Quarter by Quarter, during the Year 1892, for each of REGISTERED DEATHS from the under-mentioned DISEASES, together SANITARY DISTRICTS in question.

[The Cases are a Summary of the Weekly Returns of Notifiable Diseases received Quarterly Returns of

In Registration Divisions.	Urban Sanitary Districts.	Population (1891).	SMALL-POX. 1st Quarter. Cases.	1st Quarter. Deaths.	2nd Quarter. Cases.	2nd Quarter. Deaths.	3rd Quarter. Cases.	3rd Quarter. Deaths.	4th Quarter. Cases.	4th Quarter. Deaths	Total for 1892. Cases.	Total for 1892. Deaths.
I.	London	4,211,056	72	7	233	24	40	6	80	4	425	41
II. South-Eastern.	Croydon	102,097	2	—	2	1	—	—	—	—	4	1
	Dover	33,418	†	2	14	1	—	—	—	—	14†	3
	Eastbourne	34,977	†	—	—	—	—	—	—	—	—†	—
	Bournemouth	37,650	†	—	—	—	—	—	—	—	—†	—
	Southampton	65,325	17	1	8	—	—	—	14	—	39*	1
	Reading	60,054	—	—	—	—	—	—	—	—	—	—
III. South Midland.	Willesden	61,266	3	—	—	—	1	—	1	—	5	—
	Hornsey	44,512	†	—	—	—	2	—	—	—	2†	—
	Tottenham	71,336	†	—	5	1	—	—	—	—	5†	1
	Oxford	45,741	†	—	—	—	—	—	1	—	1§	—
	Northampton	61,016	—	—	—	—	—	—	1	—	1	—
	Cambridge	36,983	†	—	1	—	—	—	2	—	3†	—
	Leyton	63,106	†	—	—	—	—	—	—	—	—§	—
IV. Eastern.	Walthamstow	46,346	†	—	3	—	—	—	—	—	3†	—
	West Ham	204,902	—	—	4	—	2	—	—	—	6	—
	Colchester	34,559	†	—	—	—	—	—	—	—	—†	—
	Norwich	100,964	—	—	—	—	—	—	2	—	2	—
V. South-Western.	Exeter	37,580	†	—	—	—	—	—	—	—	—†	—
	Plymouth	84,179	—	—	10	—	26	1	2	—	38	1
	Devonport	54,736	†	—	1	—	9	—	2	—	12†	—
	Bath	51,843	—	—	—	—	—	—	—	—	—*	—
VI. West Midland.	Bristol	221,665	—	—	2	—	—	—	—	—	2‡	—
	St. George	36,718	†	—	—	—	—	—	—	—	—†	—
	Gloucester	39,444	†	—	—	—	—	—	—	—	—†	—
	Burton-on-Trent	46,047	—	—	—	—	—	—	5	—	5	—
	Wolverhampton	82,620	—	—	—	—	—	—	—	—	—	—
	Walsall	71,791	—	—	—	—	—	—	—	—	—	—
	West Bromwich	59,439	—	—	—	—	—	—	1	—	1	—
	Worcester	42,905	†	—	—	—	—	—	1	—	1†	—
	Smethwick	36,170	†	—	—	—	—	—	—	—	—†	—
	Birmingham	477,965	—	—	21	—	7	—	2	—	30	—
	Aston Manor	68,639	—	—	—	—	—	—	—	—	—	—
	Coventry	52,720	†	—	—	—	—	—	1	—	1†	—
VII. North Midland.	Leicester	142,051	—	—	1	—	3	1	31	5	35	6
	Grimsby	51,876	†	—	—	—	—	—	3	—	3†	—
	Nottingham	211,984	—	—	—	—	2	—	2	—	4	—
	Derby	94,146	—	—	—	—	—	—	11	—	11	—

* For 51 weeks. † Did not commence to send in returns till 18th week of the year.
‡ For 50 weeks. § For 39 weeks.

No. 11.

81 URBAN SANITARY DISTRICTS, the Number of NOTIFIED CASES and of with an ANNUAL SUMMARY of these data for each of the URBAN

Compilatio Returns of Notified In tious Disea and registe Deaths the from.

by the Board from Medical Officers of Health. The Deaths are extracted from the the Registrar-General.]

In Registration Divisions.	Urban Sanitary Districts.	Population (1891.)	SMALL-POX—*continued.* 1st Quarter. Cases.	1st Quarter. Deaths.	2nd Quarter. Cases.	2nd Quarter. Deaths.	3rd Quarter. Cases.	3rd Quarter. Deaths.	4th Quarter. Cases.	4th Quarter. Deaths.	Total for 1892. Cases.	Total for 1892. Deaths.
VIII. North-Western.	Stockport	70,253	—	—	—	—	—	—	4	—	4	—
	Macclesfield	36,009	—	—	—	—	—	—	1	—	1*	—
	Birkenhead	99,184	—	—	—	—	—	—	14	1	14	1
	Wallasey	33,227	†	—	—	—	—	—	—	—	—†	—
	Liverpool	517,951	58	7	28	4	3	—	88	2	177	13
	St. Helen's (Lancs.)	71,288	—	—	—	—	—	—	23	—	23	—
	Southport	43,026	†	—	—	—	—	—	—	—	—†	—
	Wigan	55,013	1	—	1	1	3	1	7	1	12*	3
	Warrington	52,742	—	—	4	—	98	6	348	50	450	56
	Bolton	115,002	—	—	—	—	—	—	1	—	1*	—
	Bury (Lancs)	57,206	—	—	—	—	—	—	—	—	—‡	—
	Salford	198,136	2	—	—	—	1	—	6	1	9	1
	Manchester	505,343	3	—	3	—	13	—	93	2	112	2
	Ashton-under-Lyne	40,404	—	—	—	—	—	—	5	—	5*	—
	Oldham	131,463	12	3	1	1	6	—	56	10	75	14
	Accrington	38,603	—	—	—	—	—	—	—	—	—	—
	Burnley	87,058	—	—	3	—	—	—	—	—	3	—
	Blackburn	120,064	—	—	—	—	—	—	4	—	4	—
	Darwen	34,192	—	—	1	1	—	—	—	—	1§	1
	Preston	107,573	—	—	—	—	—	—	—	—	—§	—
	Barrow-in-Furness	51,712	—	—	—	—	—	—	—	—	—	—
IX. Yorkshire.	Huddersfield	95,422	2	—	5	—	1	—	10	1	18	1
	Halifax	82,864	2	—	33	2	73	9	59	6	167	17
	Bradford	216,361	—	—	4	—	12	3	8	1	24	4
	Wakefield	33,146	6	—	22	3	18	1	29	4	75	8
	Barnsley	35,427	†	2	—	—	17	2	20	1	37†	5
	Sheffield	324,243	1	—	10	—	19	2	13	6	43	8
	Rotherham	42,050	—	—	—	—	—	—	11	1	11‡	1
	York	66,984	—	—	—	—	—	—	2	1	2	1
	Hull	199,991	—	—	—	—	1	—	4	—	5	—
	Middlesbrough	75,516	—	—	3	1	16	1	7	—	26*	2
X. Northern.	Darlington	38,060	†	—	1	—	—	—	—	—	1†	—
	Hartlepool	21,521	—	—	—	—	—	—	—	—	—‡	—
	West Hartlepool	42,402	†	—	1	—	4	1	3	—	8¶	1
	Sunderland	130,921	—	—	—	—	—	—	2	—	2*	—
	South Shields	78,431	†	—	—	—	—	—	7	1	7†	1
	Newcastle-on-Tyne	186,345	—	—	1	1	—	—	3	—	4	1
	Tynemouth	46,267	†	—	—	—	3	—	1	—	4†	—
	Carlisle	39,176	†	—	—	—	—	—	1	—	1†	—
XI. Welsh.	Newport (Mon.)	54,695	†	—	—	—	—	—	11	1	11†	1
	Cardiff	128,849	1	—	4	1	—	—	—	—	5	1
	Merthyr Tydfil	58,080	—	—	—	—	—	—	—	—	—*	—
	Swansea	90,423	—	—	1	—	1	—	2	—	4	—
		11,833,279	182	22	431	42	381	34	1,005	99	1,999	197

* For 42 weeks. ‡ For 50 weeks. † Did not commence to send in returns till 13th week of the year. § For 49 weeks. ¶ For 38 weeks.

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In Registration Divisions.	Urban Sanitary Districts.	Population (1891).	Scarlet Fever. 1st Quarter. Cases.	1st Quarter. Deaths.	2nd Quarter. Cases.	2nd Quarter. Deaths.	3rd Quarter. Cases.	3rd Quarter. Deaths.	4th Quarter. Cases.	4th Quarter. Deaths.	Total for 1892. Cases.	Total for 1892. Deaths.
I.	London	4,211,056	2,801	159	5,682	261	9,325	365	9,188	389	26,996	1,174
II. South-Eastern.	Croydon	102,697	42	1	69	3	52	—	115	3	278	7
	Dover	33,418	5†	6	56	4	24	1	33	3	118†	14
	Eastbourne	34,977	1†	—	13	1	10	—	21	—	45†	1
	Bournemouth	37,650	1†	—	8	3	28	—	35	—	72†	3
	Southampton	65,325	5	—	6	—	10	—	43	2	64*	2
	Reading	60,054	54	—	86	1	142	9	129	12	411	22
III. South Midland.	Willesden	61,266	42	2	79	1	113	—	131	5	365	8
	Hornsey	44,512	2†	—	49	1	63	2	81	2	195†	5
	Tottenham	71,336	2†	1	86	4	129	6	182	4	399†	15
	Oxford	45,741	†	2	11	—	16	—	27	—	54§	2
	Northampton	61,016	0	—	75	—	160	3	135	1	376	4
	Cambridge	36,983	1†	—	7	—	24	—	17	—	49†	—
	Leyton	63,106	†	4	124	8	184	4	244	4	552§	20
IV. Eastern.	Walthamstow	46,346	2†	—	89	3	135	4	132	9	358†	16
	West Ham	204,902	236	10	406	14	602	18	732	27	1,976	69
	Colchester	34,559	†	—	9	—	96	2	229	1	334†	3
	Norwich	100,964	22	—	34	—	54	—	235	6	345	6
V. South-Western.	Exeter	37,580	†	—	23	1	101	—	184	2	308†	3
	Plymouth	84,179	32	—	104	3	380	13	750	28	1,266	44
	Devonport	54,736	†	—	10	2	57	2	109	4	176†	8
	Bath	51,843	48	4	90	4	107	5	144	7	389*	20
VI. West Midland.	Bristol	221,665	234	5	376	14	396	13	355	13	1,361‡	45
	St. George	36,718	†	3	86	4	144	4	137	5	367†	16
	Gloucester	39,444	4†	—	48	1	148	3	164	4	364†	8
	Burton-on-Trent	46,047	65	2	66	5	51	—	130	3	312	10
	Wolverhampton	82,620	45	1	28	—	41	—	130	2	244	3
	Walsall	71,791	122	1	155	4	293	5	326	10	896	20
	West Bromwich	59,489	9	2	7	1	7	—	31	3	54	6
	Worcester	42,905	†	—	18	1	71	1	140	—	229†	2
	Smethwick	36,170	†	—	31	—	44	—	121	5	196†	5
	Birmingham	477,965	246	14	346	21	386	17	455	16	1,433	68
	Aston Manor	68,639	70	5	155	3	95	—	77	4	397	12
	Coventry	52,720	†	—	7	—	16	—	9	—	32†	—
VII. North Midland.	Leicester	142,051	179	6	233	7	353	8	688	19	1,455	40
	Grimsby	51,876	2†	—	34	1	66	—	71	2	173†	3
	Nottingham	211,984	295	9	225	9	273	14	363	12	1,156	44
	Derby	94,146	100	3	108	2	133	1	123	1	464	7

* For 51 weeks. † D'd not commence to send in returns till 13th week of the year.
‡ For 50 weeks § For 39 weeks.

Registration Division.	Urban Sanitary Districts.	Population (1891).	Scarlet Fever—*continued.* 1st Quarter. Cases.	1st Quarter. Deaths.	2nd Quarter. Cases.	2nd Quarter. Deaths.	3rd Quarter. Cases.	3rd Quarter. Deaths.	4th Quarter. Cases.	4th Quarter. Deaths.	Total for 1892. Cases.	Total for 1892. Deaths.
VIII. North-Western.	Stockport	70,253	9	—	23	1	22	—	52	—	106	1
	Macclesfield	36,009	6	—	8	—	13	—	23	—	50*	—
	Birkenhead	99,184	32	3	82	3	59	2	41	2	214	10
	Wallasey	33,227	1†	—	26	—	7	1	12	2	46†	3
	Liverpool	517,951	156	16	331	26	489	45	564	44	1,540	131
	St. Helen's (Lancs.)	71,288	36	4	93	3	182	6	125	4	436	17
	Southport	43,026	2†	19	45	—	17	—	17	—	81†	19
	Wigan	55,013	78	4	41	2	52	2	37	2	208*	10
	Warrington	52,742	28	8	137	15	206	24	131	19	502	66
	Bolton	115,002	74	2	116	8	170	6	318	14	678*	30
	Bury (Lancs)	57,206	27	3	43	4	51	2	148	7	269‡	16
	Salford	198,136	135	15	131	9	273	25	317	34	856	83
	Manchester	505,343	317	22	418	48	446	32	488	33	1,669	135
	Ashton-under-Lyne	40,494	45	2	41	1	20	—	21	3	127*	6
	Oldham	131,463	88	9	212	14	165	10	202	8	667	41
	Accrington	38,603	13	1	16	1	7	—	9	—	45	2
	Burnley	87,058	33	1	27	1	37	1	71	3	168	6
	Blackburn	120,064	28	3	55	4	37	4	56	4	176	15
	Darwen	34,192	9	—	55	6	56	5	71	5	191§	16
	Preston	107,573	89	6	160	16	315	23	262	29	826§	74
	Barrow-in-Furness	51,712	23	—	40	—	136	2	238	6	437	8
IX. Yorkshire.	Huddersfield	95,422	71	3	102	6	100	6	91	3	364	18
	Halifax	82,864	51	2	44	3	74	1	72	2	241	8
	Bradford	216,361	90	5	131	6	241	12	481	21	943	44
	Wakefield	33,146	11	1	21	1	22	2	52	—	106	4
	Barnsley	35,427	†	2	14	2	15	1	64	10	93†	15
	Sheffield	324,243	225	10	267	8	350	18	583	26	1,425	62
	Rotherham	42,050	18	5	14	1	31	1	42	3	105‡	10
	York	66,984	18	—	15	—	23	—	51	1	107	1
	Hull	199,991	105	7	113	5	121	7	159	9	498	28
	Middlesbrough	75,516	20	1	15	1	21	1	35	—	91*	3
X. Northern.	Darlington	38,060	†	—	16	1	28	1	73	—	117†	2
	Hartlepool	21,521	—	—	4	—	2	} 1	3	} 5	9‡	} 6
	West Hartlepool	42,492	†	—	1	—	23		89		113¶	
	Sunderland	130,921	90	6	42	3	96	1	170	8	407*	18
	South Shields	78,431	5†	2	83	7	107	3	155	12	350†	24
	Newcastle-on-Tyne	186,345	199	4	179	6	224	2	363	14	965	26
	Tynemouth	46,267	6†	—	15	1	26	—	45	1	92†	2
	Carlisle	39,176	1†	2	24	—	23	—	25	2	73†	4
XI. Welsh.	Newport (Mon.)	54,695	1†	1	294	5	325	14	385	8	1,005†	28
	Cardiff	128,849	456	24	678	29	376	16	343	15	1,853	84
	Merthyr Tydfil	58,080	199	13	246	15	125	11	220	16	790*	55
	Swansea	90,423	151	17	314	4	222	17	426	16	1,113	54
		11,833,279	7,628	463	13,771	653	19,666	805	23,346	999	64,411	2,920

* For 51 weeks. † Did not commence to send in returns till 13th week of the year.
‡ For 50 weeks. § For 49 weeks. ¶ For 38 weeks.

In Registration Divisions.	Urban Sanitary Districts.	Population (1891).	Scarlet Fever. 1st Quarter. Cases.	1st Quarter. Deaths.	2nd Quarter. Cases.	2nd Quarter. Deaths.	3rd Quarter. Cases.	3rd Quarter. Deaths.	4th Quarter. Cases.	4th Quarter. Deaths.	Total for 1892. Cases.	Total for 1892. Deaths.
I.	London	4,211,056	2,801	159	5,682	261	9,325	365	9,188	389	26,996	1,174
II. South-Eastern.	Croydon	102,697	42	1	69	3	52	—	115	3	278	7
	Dover	33,418	5†	6	56	4	24	1	33	3	118†	14
	Eastbourne	34,977	1†	—	13	1	10	—	21	—	45†	1
	Bournemouth	37,650	1†	—	8	3	28	—	35	—	72†	3
	Southampton	65,325	5	—	6	—	10	—	43	2	64*	2
	Reading	60,054	54	—	86	1	142	9	129	12	411	22
III. South Midland.	Willesden	61,266	42	2	79	1	113	—	131	5	365	8
	Hornsey	44,512	2†	—	49	1	63	2	81	2	195†	5
	Tottenham	71,336	2†	1	86	4	129	6	182	4	399†	15
	Oxford	45,741	†	2	11	—	16	—	27	—	54§	2
	Northampton	61,016	6	—	75	—	160	3	135	1	376	4
	Cambridge	36,983	1†	—	7	—	24	—	17	—	49†	—
	Leyton	63,106	†	4	124	8	184	4	244	4	552§	20
IV. Eastern.	Walthamstow	46,346	2†	—	89	3	135	4	132	9	358†	16
	West Ham	204,902	236	10	406	14	602	18	732	27	1,976	69
	Colchester	34,559	†	—	9	—	96	2	229	1	334†	3
	Norwich	100,964	22	—	34	—	54	—	235	6	345	6
V. South-Western.	Exeter	37,580	†	—	23	1	101	—	184	2	308†	3
	Plymouth	84,179	32	—	104	3	380	13	750	28	1,266	44
	Devonport	54,736	†	—	10	2	57	2	109	4	176†	8
	Bath	51,843	48	4	90	4	107	5	144	7	389*	20
VI. West Midland.	Bristol	221,665	234	5	376	14	396	13	355	13	1,361‡	45
	St. George	36,718	†	3	86	4	144	4	137	5	367†	16
	Gloucester	39,444	4†	—	48	1	148	3	164	4	364†	8
	Burton-on-Trent	46,047	65	2	66	5	51	—	130	3	312	10
	Wolverhampton	82,620	45	1	28	—	41	—	130	2	244	3
	Walsall	71,791	122	1	155	4	293	5	326	10	896	20
	West Bromwich	59,489	9	2	7	1	7	—	31	3	54	6
	Worcester	42,905	†	—	18	1	71	1	140	—	229†	2
	Smethwick	36,170	†	—	31	—	44	—	121	5	196†	5
	Birmingham	477,965	246	14	346	21	386	17	455	16	1,433	68
	Aston Manor	68,639	70	5	155	3	95	—	77	4	397	12
	Coventry	52,720	†	—	7	—	16	—	9	—	32†	—
VII. North Midland.	Leicester	142,051	179	6	233	7	353	8	688	19	1,455	40
	Grimsby	51,876	2†	—	34	1	66	—	71	2	173†	3
	Nottingham	211,984	295	9	225	9	273	14	363	12	1,156	44
	Derby	94,146	100	3	108	2	133	1	123	1	464	7

* For 51 weeks. † D'd not commence to send in returns till 13th week of the year.
‡ For 50 weeks § For 39 weeks.

SCARLET FEVER—*continued.*

Registration Division.	Urban Sanitary Districts.	Population (1891).	1st Quarter.		2nd Quarter.		3rd Quarter.		4th Quarter.		Total for 1892.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
VIII. North-Western.	Stockport	70,253	9	—	23	1	22	—	52	—	106	1
	Macclesfield	30,009	6	—	8	—	13	—	23	—	50*	—
	Birkenhead	99,184	32	3	82	3	59	2	41	2	214	10
	Wallasey	33,227	1†	—	26	—	7	1	12	2	46†	3
	Liverpool	517,951	156	16	331	26	489	45	564	44	1,540	131
	St. Helen's (Lancs.)	71,288	36	4	93	3	182	6	125	4	436	17
	Southport	43,026	2†	19	45	—	17	—	17	—	81†	19
	Wigan	55,013	78	4	41	2	52	2	37	2	208*	10
	Warrington	52,742	28	8	137	15	206	24	131	19	502	66
	Bolton	115,002	74	2	116	8	170	6	318	14	678*	30
	Bury (Lancs)	57,206	27	3	43	4	51	2	148	7	269‡	16
	Salford	198,136	135	15	131	9	273	25	317	34	856	83
	Manchester	505,343	317	22	418	48	446	32	488	33	1,669	135
	Ashton-under-Lyne	40,494	45	2	41	1	20	—	21	3	127*	6
	Oldham	131,463	88	9	212	14	165	10	202	8	667	41
	Accrington	38,603	13	1	16	1	7	—	9	—	45	2
	Burnley	87,058	33	1	27	1	37	1	71	3	168	6
	Blackburn	120,064	28	3	55	4	37	4	56	4	176	15
	Darwen	34,192	9	—	55	6	56	5	71	5	191§	16
	Preston	107,573	89	6	160	16	315	23	262	29	826§	74
	Barrow-in-Furness	51,712	23	—	40	—	136	2	238	6	437	8
IX. Yorkshire.	Huddersfield	95,422	71	3	102	6	100	6	91	3	364	18
	Halifax	82,864	51	2	44	3	74	1	72	2	241	8
	Bradford	216,361	90	5	131	6	241	12	481	21	943	44
	Wakefield	33,146	11	1	21	1	22	2	52	—	106	4
	Barnsley	35,427	†	2	14	2	15	1	64	10	93†	15
	Sheffield	324,243	225	10	267	8	330	18	583	26	1,425	62
	Rotherham	42,050	18	5	14	1	31	1	42	3	105‡	10
	York	66,984	18	—	15	—	23	—	51	1	107	1
	Hull	199,991	105	7	113	5	121	7	159	9	498	28
	Middlesbrough	75,516	20	1	15	1	21	1	35	—	91*	3
X. Northern.	Darlington	38,060	†	—	16	1	28	1	73	—	117†	2
	Hartlepool	21,521	—	—	4	—	2	1	3	5	9‡	6
	West Hartlepool	42,492	†	—	1	—	23		89		113¶	
	Sunderland	130,921	90	6	42	3	96	1	170	8	407*	18
	South Shields	78,431	5†	2	83	7	107	3	155	12	350†	24
	Newcastle-on-Tyne	186,345	190	4	179	6	224	2	303	14	895	26
	Tynemouth	46,267	6†	—	15	1	26	—	45	1	92†	2
	Carlisle	39,176	1†	2	24	—	23	—	25	2	73†	4
XI. Welsh.	Newport (Mon.)	54,095	1†	1	294	5	325	14	385	8	1,005†	28
	Cardiff	128,849	456	24	678	29	376	16	343	15	1,853	84
	Merthyr Tydfil	58,080	199	13	246	15	125	11	220	16	790*	55
	Swansea	90,423	151	17	314	4	222	17	426	16	1,113	54
		11,833,279	7,628	463	13,771	653	19,666	805	23,346	990	64,411	2,920

* For 51 weeks. † Did not commence to send in returns till 13th week of the year.
‡ For 50 weeks. § For 49 weeks. ¶ For 38 weeks.

App. A. No. 11.

Compilation of Returns of Notified Infectious Diseases, and registered Deaths therefrom.

In Registration Divisions.	Urban Sanitary Districts.	Population (1891).	Diphtheria.									
			1st Quarter.		2nd Quarter.		3rd Quarter.		4th Quarter.		Tot for 1	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	
I.	London - -	4,211,056	1,321	328	1,799	437	2,290	437	2,373	633	7,783	
II. South-Eastern.	Croydon -	102,697	26	5	10	3	45	11	61	18	142	
	Dover - -	33,418	†	—	2	—	1	1	2	2	5†	
	Eastbourne -	34,977	1†	3	13	1	9	—	11	1	34†	
	Bournemouth -	37,650	†	3	2	1	2	1	12	5	16†	
	Southampton -	63,325	1	—	1	—	4	—	4	1	10*	
	Reading -	60,054	10	—	7	6	6	2	15	3	38	
III. South Midland.	Willesden -	61,266	29	7	46	3	30	1	37	6	142	
	Hornsey -	44,512	5†	4	13	4	10	3	7	1	35†	
	Tottenham -	71,336	1†	1	35	6	33	7	27	7	96†	
	Oxford - -	45,741	†	2	5	—	12	8	68	15	85‡	
	Northampton -	61,016	1	—	1	—	1	1	1	1	4	
	Cambridge -	36,983	†	2	3	—	6	2	1	—	10†	
	Leyton - -	63,106	†	12	50	4	54	4	64	10	168§	
IV. Eastern.	Walthamstow -	46,346	†	7	32	3	35	10	31	8	98†	
	West Ham -	204,902	58	11	74	13	141	27	128	25	401	
	Colchester -	34,559	†	2	7	1	23	5	25	—	55†	
	Norwich -	100,964	27	4	21	2	26	4	46	6	120	
V. South-Western.	Exeter - -	37,580	†	—	4	2	7	1	3	—	14†	
	Plymouth -	84,179	8	2	8	1	11	1	24	4	51	
	Devonport -	54,736	†	1	2	—	3	2	8	1	13†	
	Bath - -	51,843	3	—	3	1	2	1	4	1	12*	
VI. West Midland.	Bristol - -	221,665	21	8	20	5	18	8	25	10	84‡	
	St. George -	36,718	†	1	3	1	2	—	4	1	9†	
	Gloucester -	39,444	1†	8	42	17	30	3	28	4	101†	
	Burton-on-Trent	46,047	5	2	8	3	11	—	19	1	43	
	Wolverhampton	82,620	1	—	8	3	4	1	5	—	18	
	Walsall	71,791	3	1	4	—	6	2	3	3	16	
	West Bromwich	59,429	—	—	5	3	2	—	—	—	7	
	Worcester -	42,905	†	—	4	3	11	1	11	3	26†	
	Smethwick -	36,170	†	—	3	—	3	1	3	2	9†	
	Birmingham -	477,965	63	9	98	19	170	24	127	22	458	
	Aston Manor -	68,639	7	—	12	1	13	—	12	1	44	
	Coventry -	52,720	1†	—	—	—	—	—	3	—	4†	
VII. North Midland.	Leicester -	142,051	12	3	13	2	18	2	26	5	69	
	Grimsby -	51,876	†	1	—	1	2	1	1	—	3†	
	Nottingham -	211,984	10	6	22	6	20	7	23	3	75	
	Derby - -	94,146	12	5	19	7	16	5	19	3	66	

* For 51 weeks. † Did not commence to send in returns till 13th week of the ye
‡ For 50 weeks. § For 39 weeks.

Division.	Urban Sanitary Districts.	Population (1891).	Diphtheria—*continued.* 1st Quarter.		2nd Quarter.		3rd Quarter.		4th Quarter.		Total for 1892.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
VIII. North-Western.	Stockport	70,253	5	1	5	2	6	1	6	6	22	10
	Macclesfield	36,009	—	—	1	2	—	—	1	—	2*	2
	Birkenhead	99,184	5	3	10	2	5	1	5	2	25	8
	Wallasey	33,227	†	4	8	—	4	—	8	—	20†	4
	Liverpool	517,951	36	8	37	11	51	22	61	15	185	56
	St. Helen's (Lancs.)	71,288	20	6	9	1	21	1	18	1	68	9
	Southport	43,026	2†	5	—	—	3	—	2	—	7†	5
	Wigan	55,013	3	2	3	—	4	1	4	2	14*	5
	Warrington	52,742	5	3	4	1	3	4	5	3	17	11
	Bolton	115,002	11	2	35	5	48	1	19	5	113*	13
	Bury (Lancs.)	57,206	8	4	4	—	10	1	9	2	31‡	7
	Salford	166,136	48	11	54	13	56	15	52	14	210	53
	Manchester	505,343	110	25	112	24	105	23	117	30	444	102
	Ashton-under-Lyne	40,494	6	4	3	1	1	—	—	—	10*	5
	Oldham	131,463	3	2	14	8	9	5	1	1	27	16
	Accrington	38,603	1	1	4	1	11	7	72	10	88	19
	Burnley	87,058	3	1	2	1	3	—	12	7	20	9
	Blackburn	120,064	—	—	3	1	—	—	—	—	3	1
	Darwen	34,192	—	—	—	—	—	—	—	—	—§	—
	Preston	107,573	5	3	6	3	9	5	9	4	29§	15
	Barrow-in-Furness	51,712	9	3	2	—	8	3	12	2	31	8
IX. Yorkshire.	Huddersfield	95,422	2	3	5	—	1	1	10	3	18	7
	Halifax	82,864	10	2	3	1	33	7	25	7	71	17
	Bradford	216,361	21	5	9	2	4	1	15	7	49	15
	Wakefield	33,146	9	1	10	—	5	—	4	1	28	2
	Barnsley	35,427	1†	—	13	3	11	—	20	1	45†	4
	Sheffield	324,243	69	19	73	20	36	16	61	24	239	79
	Rotherham	42,050	6	—	4	2	4	—	4	1	18‡	3
	York	66,984	14	5	4	2	6	3	4	1	28	11
	Hull	199,901	35	8	13	1	27	1	20	2	95	12
	Middlesbrough	75,516	8	2	9	1	6	1	—	1	23*	5
X. Northern.	Darlington	38,060	†	3	2	1	—	—	1	—	3†	4
	Hartlepool	21,521	—	} 4	—	} 1	—	} 3	3	} 5	3‡	} 13
	West Hartlepool	42,492	†		2		7		6		15¶	
	Sunderland	130,921	8	1	13	2	3	2	15	4	39*	9
	South Shields	78,431	†	3	28	2	19	2	6	6	53†	13
	Newcastle-on-Tyne	186,345	36	19	30	8	40	10	42	6	157	43
	Tynemouth	46,267	†	1	4	1	6	1	3	2	13†	5
	Carlisle	39,176	†	2	6	3	9	3	16	6	31†	14
XI. Welsh.	Newport (Mon.)	54,695	†	1	8	2	4	1	5	1	17†	5
	Cardiff	128,849	43	4	18	3	26	10	76	18	163	35
	Merthyr Tydfil	58,080	7	—	5	—	5	1	11	2	28*	3
	Swansea	90,423	2	2	12	2	1	2	4	4	19	10
		11,833,279	2,178	611	2,986	692	3,696	789	4,025	1,012	12,885	3,104

* For 51 weeks. ‡ For 50 weeks. † Did not commence to send in returns till 13th week of the year. § For 40 weeks. ¶ For 38 weeks.

App. A. No. 11.

Compilation of Returns of Notified Infectious Diseases, and registered Deaths therefrom.

In Registration Divisions.	Urban Sanitary Districts.	Population (1891).	"Fever." 1st Quarter. Cases.	1st Quarter. Deaths.	2nd Quarter. Cases.	2nd Quarter. Deaths.	3rd Quarter. Cases.	3rd Quarter. Deaths.	4th Quarter. Cases.	4th Quarter. Deaths.	Total for 1892. Cases.	Total for 1892. Deaths.
I.	London	4,211,056	386	80	483	90	866	130	898	167	2,633	467
II. South-Eastern.	Croydon	102,697	3	—	7	1	11	—	17	4	38	5
	Dover	33,418	†	1	1	1	1	2	2	1	4†	5
	Eastbourne	34,977	1†	—	4	1	4	1	5	—	14†	2
	Bournemouth	37,650	†	1	1	2	1	2	7	—	9†	5
	Southampton	65,325	6	4	7	2	45	9	22	3	80*	18
	Reading	60,054	3	—	4	—	4	4	6	4	17	8
III. South Midland.	Willesden	61,266	4	—	6	1	12	1	5	3	27	5
	Hornsey	44,512	†	—	6	—	6	6	6	1	18†	7
	Tottenham	71,336	†	5	26	4	42	9	25	—	93†	18
	Oxford	45,741	†	1	2	—	5	1	5	1	12§	3
	Northampton	61,016	2	2	2	—	8	2	1	1	13	5
	Cambridge	36,983	2†	3	2	—	22	3	19	4	45†	10
	Leyton	63,106	†	1	18	1	24	2	19	6	61§	10
IV. Eastern.	Walthamstow	46,346	†	1	5	1	15	3	6	—	26†	5
	West Ham	204,902	15	4	20	3	52	10	50	4	137	21
	Colchester	34,559	1†	—	7	2	12	2	20	5	40†	9
	Norwich	100,964	32	4	24	8	33	3	25	5	114	20
V. South-Western.	Exeter	37,580	†	2	8	—	21	2	22	3	51†	7
	Plymouth	84,179	13	3	36	6	32	5	17	4	99	18
	Devonport	54,736	†	1	3	—	7	2	1	3	11†	6
	Bath	51,843	1	2	2	—	7	2	5	1	15*	5
VI. West Midland.	Bristol	221,665	22	4	19	3	34	4	57	6	132‡	17
	St. George	36,718	†	—	5	2	9	1	11	2	25†	5
	Gloucester	39,444	†	1	2	2	6	1	4	—	12†	4
	Burton-on-Trent	46,047	21	6	18	3	13	4	7	5	59	18
	Wolverhampton	82,620	20	1	26	7	21	6	14	3	81	17
	Walsall	71,791	11	2	16	1	15	2	14	4	41	9
	West Bromwich	59,489	3	—	6	—	16	4	13	5	38	9
	Worcester	42,905	2†	7	10	4	8	1	31	2	51†	14
	Smethwick	36,170	†	2	5	—	3	1	5	1	13†	4
	Birmingham	477,985	54	13	44	7	72	7	92	11	262	38
	Aston Manor	68,639	12	3	11	1	22	2	12	4	57	10
	Coventry	52,720	†	1	3	1	13	3	35	4	51†	9
VII. North Midland.	Leicester	142,051	13	2	22	3	43	4	35	8	113	17
	Grimsby	51,876	1†	5	17	4	39	5	39	10	96†	24
	Nottingham	211,984	37	5	30	6	67	7	77	14	211	32
	Derby	94,146	13	3	11	—	14	2	15	3	53	8

* For 51 weeks. † Did not commence to send in returns till 13th week of the year.
‡ For 50 weeks. § For 39 weeks

"FEVER"—*continued.*

In Registration Divisions.	Urban Sanitary Districts.	Population (1891).	1st Quarter.		2nd Quarter.		3rd Quarter.		4th Quarter.		Total for 1892.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
VIII. North-Western.	Stockport	70,253	1	1	23	6	16	3	17	7	57	17
	Macclesfield	36,009	2	—	7	—	9	1	1	—	19*	1
	Birkenhead	99,184	33	2	15	5	38	7	70	12	156	26
	Wallasey	33,227	2†	4	6	2	13	7	30	7	51†	20
	Liverpool	517,951	152	22	139	24	238	35	343	50	872	131
	St. Helen's (Lancs.)	71,288	27	6	31	6	38	5	43	8	139	25
	Southport	43,026	†	—	6	1	7	2	20	4	33†	7
	Wigan	55,013	41	4	19	3	30	3	34	4	124*	14
	Warrington	52,742	2	1	6	1	19	5	13	3	40	10
	Bolton	115,002	14	4	15	1	16	5	50	12	95*	22
	Bury (Lancs.)	57,206	14	6	6	1	2	—	11	3	33‡	10
	Salford	198,136	78	20	45	11	128	23	106	28	357	82
	Manchester	505,343	169	35	115	22	157	30	195	42	636	129
	Ashton-under-Lyne	40,494	10	3	13	1	30	4	30	6	83*	14
	Oldham	131,463	40	9	7	2	13	4	23	2	83	17
	Accrington	38,603	3	1	4	—	7	2	10	4	24	7
	Burnley	87,058	18	4	27	5	26	6	20	3	91	18
	Blackburn	120,064	20	10	11	7	29	14	20	4	80	35
	Darwen	34,192	13	4	8	2	15	2	7	1	43§	9
	Preston	107,573	17	2	24	9	38	8	76	17	155§	36
	Barrow-in-Furness	51,712	16	—	39	6	18	1	21	2	94	9
IX. Yorkshire.	Huddersfield	93,422	6	1	3	1	10	3	7	1	26	6
	Halifax	82,864	20	3	8	1	16	1	22	3	66	8
	Bradford	216,361	16	3	9	1	34	9	20	6	79	19
	Wakefield	33,146	8	2	5	1	5	1	10	2	28	6
	Barnsley	35,427	†	2	2	1	5	2	2	—	9†	5
	Sheffield	324,243	72	12	37	10	54	10	44	6	207	38
	Rotherham	42,050	16	12	5	3	6	3	8	1	35‡	19
	York	66,984	17	5	12	1	86	8	63	12	178	26
	Hull	190,891	21	2	20	7	47	11	62	14	150	34
	Middlesbrough	75,516	11	6	7	1	21	4	23	6	62*	17
X. Northern.	Darlington	38,060	2†	1	2	1	7	—	31	1	42†	3
	Hartlepool	21,521	4	2	4	1	6	7	1	3	15‡	13
	West Hartlepool	42,402	†		—		11		6		17¶	
	Sunderland	130,921	41	6	30	8	229	20	141	23	441*	57
	South Shields	78,431	1†	7	13	8	16	4	13	11	43†	30
	Newcastle-on-Tyne	186,345	26	3	30	3	33	5	20	2	109	13
	Tynemouth	46,267	†	3	7	2	1	—	4	—	12†	5
	Carlisle	39,176	1†	1	22	5	11	—	12	1	46†	7
XI. Welsh.	Newport (Mon.)	54,695	†	2	4	1	116	2	56	—	176†	5
	Cardiff	128,849	33	7	12	3	40	11	36	5	130	26
	Merthyr Tydfil	58,080	15	2	23	2	6	1	10	4	54*	9
	Swansea	90,423	20	3	20	3	60	4	97	14	197	24
		11,853,279	1,080	393	1,760	346	3,342	528	3,472	636	10,254	1,903

* For 51 weeks. † Did not commence to send in returns till 13th week of the year.
‡ For 50 weeks. § For 49 weeks. ¶ For 38 weeks.

No. 12.

Report on the Origin and Progress of the Western Diffusion of Cholera during the Year 1892; by Dr. F. W. Barry.

The following account of the Western diffusion of cholera in 1892, which I have prepared in accordance with instructions, is to be regarded as a contribution only towards the history of the epidemic in that year, pending the issue by the several Governments concerned of complete official reports. The materials from which this account has been drawn up consist largely of statistics collected in the Department, and obtained from official and from non-official sources. Amongst the former are included documents communicated to the Board by the Foreign and Colonial Offices, by means of which the information obtained from non-official sources has in many instances been corrected or verified. Complete official reports dealing with the whole year 1892 have, up to the date of writing, been received with respect to the Department of the Seine* in France, the States of Hamburg† in Germany, the Austrian portion‡ of the Austro-Hungarian Empire, the city of Budapest,§ and the town of Havre.‖

In addition to these, an official Memorandum¶ with respect to cholera in the German Empire from the commencement of the epidemic to November 19th, 1892, and a statistical account** of cholera in Hungary have been published. I am also indebted for much information to non-official papers with respect to cholera in the Department of Seine-et-Oise by Drs. Proust, Netter, and Thoinot,†† and in Belgium by M. Beco.‡‡ I have further had the advantage of consulting Dr. Clemow's very complete account§§ of the epidemic in the Russian Empire, from its commencement to December 1st (old style), 1892, and a series of papers‖‖ which appeared in the "Lancet," dealing with the epidemic in France.

In the first instance, I propose to give a short summary of the Western march of cholera during 1892, and afterwards to deal with the history of the disease in the several countries invaded.

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* L'Épidémie Cholérique de 1892, dans le Département de la Seine. Conseil d'hygiène publique, et de salubrité du Département de de Seine, Préfecture de Police. Paris, 1893.

† Bericht des Medicinal-Inspectorats über die Medicinische Statistik des Hamburgischen Staates für das Jahr 1892. Dr. Reinecke pp. 28–50.

‡ Die Cholera in den im Reichsrathe vertretenen Königreichen und Ländern im Jahr 1892. Published as a separate number of the Wochenschrift das Oesterreichische Sanitätswesen. January 19, 1893.

§ Tiszti Főorvosi Hivatal Jelentesé a Budapest fö- és székvárosban 1892/93 évben fellépett Choleráról. Budapest, 1893.

‖ Ville du Havre. Bureau Municipal d'Hygiène. Relevé Général de la Statistique Démographique et Médicale avec Texte explicatif pour une période décennale 1880–1889. Supplement.—Épidémie de Choléra en 1892, par M. le Docteur Gibert. Havre 1893.

¶ Denkschrift über die Choleraepidemie, 1892.

** Hieronymi Károly Magyar Királyi Belügyminiszter Jelentése az ország Közegészségi viszonyairól az 1892-ik évben. Budapest, 1893, pp. viii–ix, 58–64.

*† Le choléra dans le Département de Seine-et-Oise en 1892, par MM. les Drs. Proust, Netter et Thoinot. (Revue D'Hygiène et de Police Sanitaire, Tome XV., pp. 577–619. Paris, 1893.)

‡‡ Communication concernant l'Épidémie de choléra de 1892 en faite, Séance du Conseil Supérieur d'Hygiène publique, le 13 Octobre 1892, par Émile Beco, Secrétaire Général du Ministère de l'Agriculture, de l'Industrie et des Travaux Publics, chargé de la direction générale du service de santé et de l'Hygiène. Bruxelles, 1893.

§§ The cholera epidemic of 1892 in the Russian Empire with notes upon treatment and methods of disinfection in Cholera, and a short account of the conference on cholera held in St. Petersburg in December 1892, by Frank Clemow, M.D., Longmans, Green, & Co., London and New York, 1893.

‖‖ Cholera in France, from our special correspondent "Lancet."

At the commencement of 1892, cholera was still lingering in the Vilayets of Damascus and Beyrout in Syria, and in those of Hedjaz and of Yemen in Arabia, the remains of a diffusion along the pilgrim route in 1890–91, but each of these districts, with the exception of Hedjaz, was reported to be free from the disease before the end of the first quarter of the year. Before cholera had entirely died down in Yemen travellers from thence had infected the Somali Coast of Africa, where early in May the disease was reported to be raging violently. There were rumours also of the presence of cholera in Afghanistan during the winter of 1891–92, but their truth had not been fully established.

In the following Table I. will be found a summary, giving the dates when cholera was first recognised in the more important localities invaded during 1892, together with notes as to the reputed origin of the infection. The information with regard to the origin of the infection is not given in the case of large towns situate in countries in which cholera had at the time become prevalent.

TABLE I.

Date of first recognised case of Cholera.	Name of Town.	Country.	Reputed Origin of the Infection.	Character of Outbreak.
March 31	Nanterre	France	?	Epidemic.
„ 15	? *Jelalabad*	Afghanistan	? Hardwár	„
„ 19	*Kabul*	„	? Jelalabad	„
„ 21	Paris	France	?	„
„ ? 30	*Harrar*	Africa	Yemen	„
May ? 1	*Herat*	Afghanistan	Kabul	„
„ 6	*Srinagar*	Kashmir	Punjab	„
„ 7	*Turbat-i-Sheikh-Jam.*	Persia	Herat	„
„ 27	*Meshed*	„	Turbat-i-Sheikh-Jam.	„
„ 31	*Kaachka*	Russian Turkestan	Meshed	„
June 18	Baku	Russian Caucasus	Russian Turkestan	„
„ 24	Astrakhan	Russia in Europe	Baku	„
July 5	Havre	France	Courbevoie	„
„ 6	Rostof-on-Don	Russia in Europe	Baku	„
„ 20	Aspelaere	Belgium	Argenteuil	Isolated case.
„ 29	Etichove	„	Aubervilliers	„ „
Aug. 1	St. Petersburg	Russia	?	Epidemic.
„ 1	*Teheran*	Persia	?	„
„ 5	Moscow	Russia	?	„
„ 13	Lublin	Russian Poland	?	„
„ 13	Jumet	Belgium	Sarcelles	A few cases.
„ 15	*Ispahan*	Persia	?	Epidemic.
„ 15	Antwerp	Belgium	Havre	Several cases.
„ 16	Hamburg	Germany	? { Russia / Havre }	Epidemic.
„ 19	Grangemouth	Scotland	Hamburg	Isolated cases.
„ 25	London	England	„	„ „
„ 26	Rotterdam	Holland	„	Several cases.

Date of first recog. nised case of Cholera.	Name of Town.	Country.	Reputed Origin of the Infection.	Character of Outbreak.
Aug. 28	Aarhus	Denmark	Hamburg	Isolated cases.
„ 29	Amsterdam	Holland	„	„ „
„ 31	*Tangiers*	Morocco	„	„ „
Sept. 2	Capri	Italy	„	„ „
„ 4	Christiansund	Norway	„	„ „
„ 4	*Loheiya*	Arabia	Somaliland	Epidemic.
„ 8	Podgorze	Austria	? Russia	„
„ 9	*Trebizond*	Turkey in Asia	Russia	„
„ 11	Cracow	Austrian Poland	? Russia	Several cases.
„ 12	*Erzeroum*	Turkey in Asia	? { Russia / Persia }	Epidemic.
„ 15	*New York*	United States	Hamburg	Isolated cases.
„ 15	*Hodeidah*	Arabia	Loheiya	Epidemic.
„ 26	Buda-Pest	Hungary	? Hamburg	„
Oct. 19	Semendria	Servia	Hungary	A few cases.
„ 24	Belgrade	„	Semendria	„
Nov. 14	Husiatyn	Austria	Russia	„

Names of places outside Europe, printed in italics. For the purposes of this Report the Caucasus is regarded as part of Europe.

From the above list some notion may be obtained of the extent of the diffusion of cholera in 1892, a diffusion which was in some respects utterly unlike any previously recorded, for it extended from three centres, one western, commencing in the suburbs of Paris, and extending slowly from point to point in France, more especially towards the north and west, and subsequently invading Belgium, and thence to some extent Holland; the other two, eastern, spreading, in the one instance, from Herat in Afghanistan by way of Persia to Russian Turkestan, and thence with unprecedented rapidity across the Caspian, through the Caucasus, and through European Russia, its course being generally marked by violent outbursts and wide diffusions; the other which was practically a continuation of the epidemic of 1890–91 affecting Arabia and the Somali coast of Africa only.

The outbreak in France, which like that of Spain in 1890 is generally regarded to have been a recrudescence of former cholera, commenced at Nanterre, one of the suburbs of Paris on March 31st, extended to the neighbouring communes, and reached Paris on April 21st. Thence it followed the course of the Seine, and reached the sea coast at Havre, on July 5th.

The outbreak in Afghanistan spread to Persia on May 7th, thence to Russian Turkestan (Kaachka), on the 31st, and from thence passed along the line of railway to the Caspian Sea in one direction, and to Samarkand in the other. It reached Baku, in the Caucasus on June 18th, Astrakhan at the mouth of the Volga on the 24th, and from these two points rapidly invaded nearly every province in Russia, reaching St. Petersburg and Moscow by the beginning of August, and Poland before the end of the second week in the same month. On August 16th, cholera appeared at Hamburg, and spread there with enormous rapidity.

From Hamburg it extended to a large number of places in Germany, and isolated cases were conveyed on ship-board to the British Islands, to Norway, Denmark, Italy, Morocco, and the United States of America. From Hamburg also, cholera was conveyed to Belgium—a country which had already been invaded by cholera from France—and to Holland. The outbreaks in Austria and Hungary followed the introduction of persons or of goods from Hamburg or from Russia, whilst the disease was introduced into Servia from Hungary.

The diffusion was not confined to Europe; it affected nearly the whole of Persia, the vilayets of Van and of Ezeroum in Turkey in Asia, as well as the greater part of the Russian possessions in Central Asia, and a considerable portion of Siberia.

The extent and intensity of the diffusion may to some degree be appreciated by a consideration of the following Table II., in which a summary is given of the number of deaths, and of cases occurring in the several countries affected, as far as they can be gleaned from the statistics that have been published.

TABLE II.

Country.	Population.		Date of First Recorded Attack of Cholera.	Reported Cholera.		Period to which the Figures in the two preceding columns refer.
	Number.	Date of Census.		Attacks.	Deaths.	
France - - -	38,343,192	1891	March 31 - -	?	4,550	March 31 to Dec. 31.
Somaliland - - -	?	—	April ? - -	?	10,000 (about)	Epidemic period.
Afghanistan - -	4,000,000	estimated	„ 15 - -	?	7,000 (about)	„ „
Kashmir (Srinagar)	120,340	1891	May 6 - -	8,928	5,736	May 6 to June 30.
Persia - - -	7,500,000	estimated	„ 7 - -	?	63,982	„ 7 to Dec. 26.
Central Asiatic Russia -	5,327,098	1885	„ 31 - -	58,102	31,804	„ 31 to Dec. 13.
Caucasus - - -	7,284,527	„	June 18 - -	134,758	69,423	June 18 to „ 13.
Russia in Europe - -	95,990,175	*	„ 24 - -	331,077	151,626	„ 24 to „ 13.
Belgium - - -	6,069,321	1890	July 20 - -	1,852	961	July 20 to Dec. 31.
Siberia - - - -	4,313,680	1880	„ 24 - -	31,097	15,037	„ 24 to Dec. 13.
Turkey in Asia (exclusive of Arabia).	?	—	„ 26 - -	9,000 (about)	5,000 (about)	„ 26 to „ 31.
Germany - - -	49,428,470	1890	Aug. 16 - -	18,625	9,563	Aug. 16 to Nov. 19.
Scotland - - -	4,025,647	1891	„ 19 - -	4	1	Year 1892.
England - - -	29,002,525	„	„ 25 - -	35	11	„ „
Holland - - -	4,511,415	1889	„ 26 - -	?	293	„ „
Denmark - - -	2,185,335	1890	„ 28 - -	4	2	„ „
Morocco - - -	8,000,000	estimated	„ 31 - -	?	2	„ „
Italy - - - -	30,158,408	1890	Sept. 2 - -	2	2	„ „
Norway - - -	1,988,674	1891	„ 4 - -	2	2	„ „
Arabia - - -	?	—	„ 4 - -	?	2,000 (about)	„ „
Austria - - -	23,748,092	1890	„ 11 - -	214	125	„ „
United States - -	62,622,250	1892	„ 15 - -	88	55	„ „
Hungary - - -	17,463,789	1890	„ 26 - -	2,231	1,255	„ „
Servia - - -	2,161,962	1890	Oct. 21 - -	33	19	„ „

* *Russia in Europe* 1886, Poland 1890, Finland 1889.

I have already stated that the western diffusion of cholera in 1892 extended from three centres, in France, in Afghanistan, and in Arabia respectively, and that of these the two first-named were established in March and in May respectively, whilst the third was already in existence at the beginning of the year. Notwithstanding the fact that cholera was reported to have appeared in Arabia and in France before it did in Afghanistan, I propose to consider first in order the progress of cholera in its march westwards along the northern overland route through Afghanistan and Persia, a route by which cholera had invaded European Russia in 1823, 1830, and 1846, but never since until 1892.

Afghanistan.

On March 8th, 1892, a telegram from Teheran, dated March 7th, appeared in the "Times," in which it was stated that cholera was raging at Herat, and that the disease was advancing, cases having been reported from Kuhsan on the Herat and Meshed road; but in a telegram from the same source, dated April 5th, doubts were expressed as to the genuine nature of the epidemic. There, however, appears to be no question that cholera was prevailing extensively at Herat early in May 1892.

Two accounts, differing very widely, have been given with respect to the progress of cholera in Afghanistan. According to one account,* the epidemic commenced at Jelalabad, about the month of December 1891, spreading to Kabul, and thence traversing the mountainous territory separating Kabul from Herat, finally reaching the latter place in March 1892.

According to the second account,† cholera is reported to have first appeared in Afghanistan (? Jelalabad) on April 15th, 1892, the disease reaching Kabul on April 19th, from which date to April 29th, 5,575 deaths from cholera are said to have taken place there. From Kabul the disease was conveyed to Herat, where, by the second week in May, 2,000 deaths were reported to have occurred.

Both accounts agree in tracing the importation of the disease from India. In view of these statements it will be useful to consider briefly the facts with respect to the diffusion of cholera in India at the end of 1891 and the beginning of 1892, in order to ascertain if any special circumstances existed in that country which would favour the introduction of cholera into Afghanistan at either period.

India.

From the official records‡ it appears that cholera was in 1891 prevalent amongst the general population throughout almost the whole of India, and that the total number of deaths recorded as due to it was 601,603, the highest figure recorded in any year since 1877, and equivalent to a death-rate of upwards of 28 per 10,000 of the population. The deaths month by month in each province are recorded in Table III. . . . . .

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* La Revûe Medico Pharmâceutique, Constantinople, August 31st, 1892.

† Hygienische Rundschau, September 15, 1892.

‡ Annual Report of the Sanitary Commissioner with the Government of India, 1891. Calcutta, 1893.

TABLE III.

SHOWING the DEATHS from CHOLERA Registered in the several PROVINCES of INDIA Month by Month during the Year 1891.

PROVINCE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Mortality from Cholera per 10,000 of the Population.
Bengal	15,694	15,305	26,775	44,769	26,818	18,306	20,049	14,548	6,844	6,466	13,652	20,349	229,575	32·6
Assam	998	1,045	2,307	5,009	5,656	2,669	1,463	920	914	1,053	1,017	831	23,882	47·6
North-West Provinces and Oudh	718	1,115	2,077	13,273	31,915	34,453	32,018	12,110	10,301	10,213	10,842	9,978	169,013	36·0
Punjab	—	—	—	14	167	181	1,595	2,263	3,375	2,193	266	53	10,107	4·9
Central Provinces	75	89	546	1,630	3,309	6,147	3,985	1416	1,391	1,836	728	70	21,312	24·9
Berar	9	2	36	—	—	34	368	3,139	3,081	1,186	95	8	7,958	28·0
Lower Burma	92	84	140	353	513	252	131	306	88	101	126	214	2,400	8·2
Madras Presidency	5,912	2,837	1,971	2,937	2,702	3,462	9,856	16,258	9,072	7,064	12,280	23,823	98,773	35·0
Bombay Presidency	256	149	63	214	1,315	2,656	3,698	4,457	3,427	901	413	322	17,850	9·5
Mysore	68	23	71	63	68	187	142	215	154	95	41	77	1,204	8·8
Coorg	—	—	—	—	—	—	—	—	—	—	7	—	7	0·4
Total	23,822	20,649	33,986	68,262	72,553	68,347	73,305	55,612	30,247	31,108	39,466	55,724	582,081	30·1

From the above Table it will be observed that cholera was prevale throughout the whole year, and that although at its maximum duri the four months April to July, the deaths recorded in December we exceptionally numerous. There was thus, as regards the whole of Ind a special prevalence of cholera in 1891, and a great mortality from tl disease in December. But special danger to Afghanistan as regar cholera invasion could only come either by way of the Punjab or way of Biluchistan, where the frontiers of these provinces are cot minous with that of Afghanistan. From Table III. it will be observ that the death-rate from cholera in the Punjab during 1891 was un ·5 per 10,000 of the population, a not exceptional rate for that provinc but on examining the Report for the Punjab* it appears that where 10,107 deaths were recorded for the whole province in a populati of upwards of 20,000,000, no less than 3,863 deaths from cholera, upwards of one-third the total number, occurred in the districts Pesháwar and Kohát, the aggregate population of which is less th 1,000,000. The cholera mortality rates in the districts of Pesháw and Kohát were 48·2 and 35·7 per 10,000 of their total popalatio respectively, whilst the rate observed in the town of Pesháwar, town between which and Afghanistan there is much communicatio reached 56 per 10,000, and here cholera is reported to have be prevalent from July 5th to December 19th.

As regards Biluchistan also, it appears from the Annual Report† the Sanitary Commissioner with the Government of India that chole was more or less prevalent there during the second half of the year 18 He makes reference to the facts that in August and September seve outbreaks occurred in some villages and in a nomad encampment the Quetta district; that late in these months certain villages of t Pishin district (situate north of Quetta on the Kandahar Road) we severely affected, and that amongst other places invaded towards t end of the year, cholera attacked the coolies engaged in the reconstru tion of the railway in the Bolan Pass.

There were thus, at the end of 1891, special circumstances existing the Punjab and in Biluchistan favourable to the spread of cholera Afghanistan.

In the early months of 1892 a special diffusion of cholera, which w well marked in the provinces on the Indo-Afghan frontier, took pla in India, upon the compulsory dispersion of pilgrims attending t Hardwár fair. From the Annual Report‡ for 1892 of the Sanita Commissioner of the North-West Provinces and Oudh it appears th cholera broke out at the Mahavaruni Fair at Hardwár on March 22n 1892, before the great bathing festivals on the 26th and 28th of t same month. At that time 70,000 persons were assembled, and it w estimated that 200,000 more were on their way to Hardwár. (March 25th, those already at the place were dispersed, and tho en route were prevented from proceeding, and although only 53 deat from cholera were reported to have taken place at Hardwár among persons attending the fair, a considerable number were attacked they were returning home, and by this means cholera was introduc into distant provinces. In this manner the disease was spread alo the route of the North-Western Railway through the Punjab, so

* Report on the sanitary administration of the Punjab for the year 1891. Lah 1892.

† Op. cit., p. 124.

‡ Twenty-fifth Annual Report of the Sanitary Commissioner of the Nort western Provinces and Oudh for the year ending December 1892. Allahabad 18

20 deaths occurring in the special trains provided for the conveyance of pilgrims from Hardwár, and soon afterwards cholera broke out in an epidemic form in several districts of the Punjab.

The type of this epidemic was extremely virulent, as will be seen from the following brief account of its course in Kashmir, for which I am indebted to a paper by Surgeon-Colonel R. Harvey,* who was deputed by the Government of India to investigate the epidemic there.

From this account it appears that cholera was prevalent in April in the Rawul Pindi and Hazara districts of the Punjab, which are both situate between Kashmir and the Peshawár district of the Punjab. The first case of cholera in Kashmir occurred on April 24th at Domel, where the two roads from Rawul Pindi and Hazara meet, and on May 6th the disease was introduced into Srinagar (population 124,000) the chief town of Kashmir, by a boatman from Baramulla, a village situate at the terminus of the cart road from Domel. Once introduced, the disease spread with great rapidity, as will be seen from the following Table IV.

TABLE IV.

STATISTICS of CHOLERA at SRINAGAR during eight weeks ended June 30th, 1892.

Week of Disease.	Reported Cholera attacks.	Reported Cholera Deaths.
1st week ending May 12th, 1892 - -	120	37
2nd „ „ „ 19th „ - -	1,105	472
3rd „ „ „ 26th „ - -	2,682	1,455
4th „ „ June 2nd „ - -	2,507	1,803
5th „ „ „ 9th „ - -	1,620	1,193
6th „ „ „ 16th „ - -	622	525
7th „ „ „ 23rd „ - -	184	218
8th „ „ „ 30th „ - -	48	33
Total for eight weeks - -	8,928	5,736

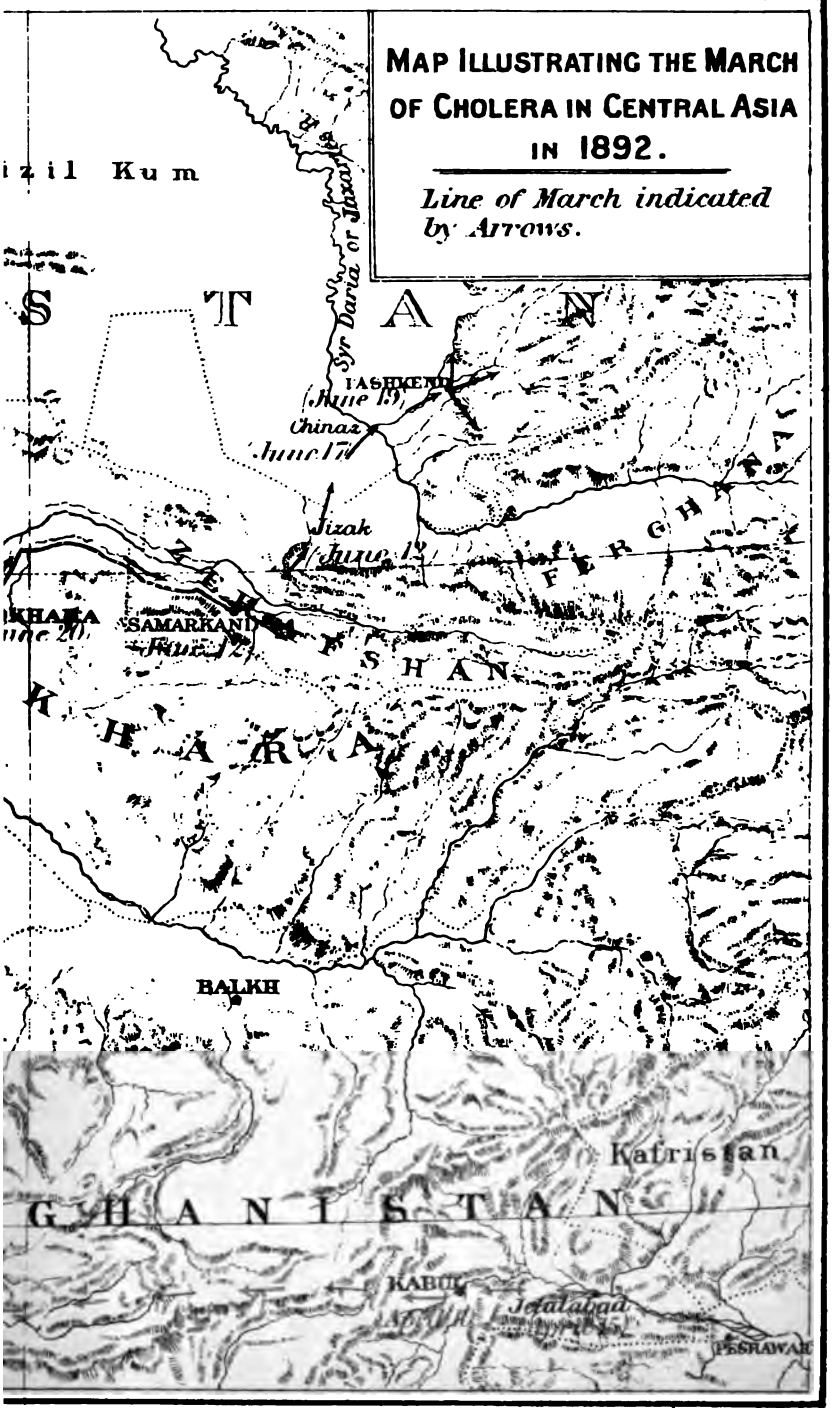
The total attacks and deaths which took place in eight weeks in Srinagar were equivalent to an attack-rate and to a death-rate from cholera of 721 and 463 per 10,000 of the population respectively. These figures further give a fatality rate of 64·2 per cent.

It will thus be seen that in the spring of 1892, immediately prior to the alleged invasion of Afghanistan by cholera from India, cholera of a particularly virulent type was actually epidemic in the north-west of the Punjab within easy reach of the Afghan frontier.

PERSIA.

Cholera is reported to have been introduced into Persia by Afghan nomads travelling from Herat to Turbat-i-Sheikh-Jam, a town situate on the high road halfway between Herat and Meshed, the capital town of Persian Khorasan. Shortly after the arrival of these people at Turbat-i-Sheikh-Jam on May 7th the Governor of the town and two members of his household were attacked by cholera and died. By

* A brief sketch of the epidemic of cholera in Srinagar, Kashmir, May—June, 1892, by Surgeon-Colonel R. Harvey, M.D., D.S.O British Medical Journal, Vol. II. 1892, p. 345.



Judd & Co Ltd Lith. 5406 / 92

May 18th there were reported to have been 180 cases of cholera in the place, of which 60 had proved fatal. At this date, also, cholera was reported to be prevalent in the villages situate on the first half of the road between Turbat-i-Sheikh-Jam and Meshed.

On May 27th Her Majesty's Minister at Teheran telegraphed to the effect that cholera had appeared at Meshed, and that there were 50 cases there. Meshed is a city with a population of upwards of 60,000 persons, amongst whom cholera spread rapidly, and in consequence of the panic caused by this, large numbers of the inhabitants left the place. By these fugitives cholera was carried in three directions, (*a*) directly northward through the Dewah-Boine Pass to Kaachka in Russian Transcaspia, where the appearance of the disease was reported on May 31st, (*b*) to the north-west along the valley of the River Atrek, where during the early part of June cholera was reported in the districts of Deregez, Kuchan, and Bujnurd, spreading thence towards the end of June to Desti-Shah, and reaching Astrabad early in July, and (*c*) on the main road running westward from Meshed to Teheran. On this road cholera successively invaded Nishapur, Sebzewar, Mazinan, Abbasabad, and Damghan during the month of June. In July the disease spread to Semnan and other towns and villages on the road to Teheran, at which place cases of cholera first occurred on August 1st.

The chief lines of march followed by cholera in 1892 in Persia and in Central Asia are shown in Map I.

In the meantime an importation of cholera brought by fugitives coming by steamer from Baku had taken place at Enzeli, a port on the Caspian Sea, in the Province of Azerbaijan, about the end of June, 15 deaths being reported to have occurred there in the week ending July 3rd. From thence it spread to the neighbouring towns, of which Resht was the most important, and where by the end of July deaths from cholera were occurring at the rate of 50 per day. During August a great extension of the epidemic prevalence of the disease took place to the east and south of the already invaded provinces. Without tracing the route of the disease with any great detail, it may be noted that from Teheran, cholera spread along the main caravan routes, and in this manner it extended from Teheran along the north-west route to Kazvin, Zinjan, and Tabriz, and from thence to Khoi, Urumiah, Suj-Bulak, and other towns and villages near to lake Urumiah, reaching in this direction the Turkish frontier. On the western route the disease spread to the Gerus district and to Hamadan. On the southern route cholera appeared successively at Kum, Ardebal, and Kashan, and from Kashan, where the main caravan route divides into two, passing south-east and south-west respectively, it travelled in both directions, on the south-eastern route invading Ardistan, Ardakan, Maibut, and Yezd, and on the south-western route attacking the towns of Ispahan, Yulfa, Arsinjan, and Shiraz.

From the numerous centres thus formed the disease spread to many other towns and villages, finally reaching Bunder Abbas at the mouth of the Persian Gulf in November.

At the end of the year the disease was still prevalent in the district of Kermanshah, and the Province of Luristan on the Turkish frontier, and the southern Province of Luristan on the Persian Gulf.

The rapid dissemination of cholera in Persia was largely due to the fact that as soon as a town became invaded the great bulk of the inhabitants fled to the neighbouring villages, thus spreading the disease. At Teheran, with a population of about 100,000, it is estimated that at least 70,000 left the town. Among the fugitives were included many members of the Government and even some members of the Imperial

Health Department, which last-named body suspended its sittings during the height of the epidemic. At Tabriz likewise the Governor, together with most of the officials and well-to-do inhabitants, fled from the place on the appearance of cholera.

No reliable figures are available as to the mortality from cholera in Persia in 1892; it is, however, quite certain that it was very great. The total deaths according to the official returns* amounted to 63,982, but the figures in these returns are believed to have been much understated, the actual number of deaths being estimated, according to the lowest computation, at 80,000, and this in a population of some 7,500,000.

In some of the large towns the cholera mortality was enormous. At Meshed, with a population of about 60,000 persons, there were said to have been 5,000 deaths during June and July. At Teheran, with a population of about 100,000, 20,000 persons are reported to have died during the epidemic period (this number including deaths amongst fugitives), and during the first three weeks of August no less than 15,000 deaths are reported to have occurred at Tabriz (population about 100,000).

The intensity of the disease is believed to have been caused to some extent by the practice of washing the corpses of persons who had died from cholera in streams and conduits, the water of which was immediately afterwards used for cooking, baking, and drinking purposes, practices with which the local authorities did not attempt to interfere. At Teheran an extension of the disease was observed under the following circumstances. On August 14th, with a view to exorcising the epidemic, some thousands of the inhabitants made a pilgrimage to the Mosque of Shah Abdul-Azim, situate some seven miles south of Teheran. The day when the pilgrimage took place was exceedingly hot, and on the return journey numbers of the pilgrims were attacked by cholera, and many died on the road, and others in railway carriages. On the two following days 18,00 fresh cases of cholera and 600 deaths were reported to have occurred at Teheran. During the week following, the attacks and deaths from cholera amounted to 3,500 and 2,200 respectively.

At Tabriz also the greatest mortality from the disease was reported to have occurred during August, at which time there was great religious excitement in connexion with celebrations in memory of Hussein the Martyr. From August 15th to September 5th, 6,600 attacks and 3,500 deaths from cholera are reported to have taken place at Tabriz.

The only measures apparently taken by the Persian authorities to check the spread of cholera were the formation of military cordons, first, when cholera was prevalent in Herat, along the Perso-Afghan frontier, and later, when the disease was introduced into Persia, around each town as it became invaded. From the foregoing short account it is clear that the formation of these cordons was of little practical utility.

Russia.

From information published officially in the Russian "Messager Officiel,"† it appears that early in March 1892 a report had been received by the Russian Government of the appearance of cholera at Herat, and in view of the possibility of the spread of the disease to Persia, some Russian doctors were at once despatched to that country to observe and report upon the progress of the epidemic. At the same

* Das Österreichische Sanitätswesen 1893, p. 80.

† Communicated in a despatch from Her Majesty's Consul-General at St. Petersburg, June 27th, 1892.

time a Special Commission was established by the Medical Department of the Ministry of the Interior to devise measures to prevent the spread of the disease into Russian territory. This Commission, amongst other things, proposed (1) the strengthening of the sanitary cordon on the frontiers of Persia and of Afghanistan; (2) the medical examination of all persons crossing these frontiers; the isolation of all persons exhibiting symptoms suspicious of cholera, and the disinfection of their goods; (3) the establishment of "observation" and "reception" points* on the line of the Transcaspian Railway; (4) the prohibition of pilgrimages to Persia; (5) an increased sanitary supervision upon the coasts of the Caspian Sea, and the sending beforehand of medical men to localities threatened by cholera.

It was decided that the measures detailed above should be put in force on the appearance of cholera at Meshed. In consequence of the spread of cholera in Afghanistan, however, the Afghano-Russian frontier was closed about the middle of May. The sanitary supervision of Persia leaving much to be desired, an understanding was agreed upon by the intervention of the Ministry of Foreign Affairs with the Persian Government that it would conscientiously apply the measures ordered, and that it would lend its help to the Russian physicians to combat cholera. On May 15/27 an outbreak of cholera was reported to have occurred in Meshed, and in accordance with the recommendations of the special Commission quoted above, the communication between Russia and Persia was put under strict regulations, as regards the eastern half of the frontier between Russian Turkestan and Persia along which no marked geographical feature separates the two countries. Along this portion of the frontier some 310 miles in length, the already existing sanitary cordon was strengthened, and 10 stations were established at intervals along this line, at which points only, travellers from Persia could gain access to Russian Turkestan, and at which such persons were subjected to a quarantine of three days. Along the western half of the frontier, between the Transcaspian province and Persia, where the Kopet-Dagh mountains form a natural division, no cordon was regarded as necessary. At a later date the period of quarantine enforced at the stations on the Persian frontier was extended to seven days, and on June 28/July 10 the whole of the Russo-Persian frontier as far as the Caspian Sea, was closed. Further a sanitary cordon was established on the Caucasian frontier where it adjoins that of Persia, and here three stations, through one or other of which all travellers had to pass were established at Béliasouvara, Djoulfa, and at Djébrail.

Notwithstanding these precautions, cholera appeared at Kuachka on May 19/31 four days after its reported outbreak in Meshed. Kuachka which is situate in Transcaspia, 87 miles north of Meshed, comprises a

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* "Observation" and "reception points" are defined by Dr. Clemow as follows:—

"The 'observation points' were stations or landing stages where the following "measures were carried out. All passengers were subjected to inspection "by a medical man, and any person showing suspicious symptoms was "detained until the nature of the ailment declared itself. Accommodation was "provided for the isolation and treatment of patients and provision made "for the inevitable bacteriological investigation. Finally, all goods and "passengers' luggage were here disinfected.

"The 'reception points' were lazarets or barracks constructed for the reception and "treatment of cholera patients along the course of rivers and railways. They "coincided in many instances with the observation points; in other words, "wherever inspection and disinfection were carried out, there was provided "accommodation for the reception of patients, but the reverse was not "universally the case."—Clemow, op. cit., pp. 66, 67.

Turkoman Settlement (aoul) and a Russian town, and has a station on the Transcaspian railway. This railway which was first opened for traffic in 1888, forms a means of communication between the Caspian Sea on the west, and Samarkand on the east. In its course it runs through the important towns of Askhabad, Merv, and Bokhara. Kaachka is situate 370 miles from Oozoun Ada, the Caspian terminus of the railway. The line from Kaachka to Oozoun Ada passes through barren steppes, with the Kopet Dagh Mountains on the south, and the Great Kara Dum desert on the north, the only towns of importance on the way being Askhabad the capital town of the Transcaspian province, and Kizil-Arvat. (See Map I.)

From May 19/31 when the first cases of cholera were reported to have occurred in Kaachka to June 10/22, 43 of the inhabitants were officially reported to have been attacked, and of these 41 died. In addition, one of the soldiers forming the sanitary cordon around the aoul, and a woman at Aksu Station were attacked.

As soon as the disease appeared in Kaachka strenuous efforts were made by the local authorities to prevent its spread along the line of railway, and in addition to the establishment of "observation" and "reception" points at various stations both to the east and to the west of Kaachka, a land quarantine of seven days (extended on June 17/29 to 14 days) was directed at Bala-Ishem the third station from the Caspian end of the railway, for all passengers travelling westward. In spite of this, however, on May 25/June 6, six days after the appearance of cholera in Kaachka, three Persians sickened and died of the disease at Oozoun Ada.

With a view to preventing the introduction of cholera into the Caucasus and European Russia by way of the Caspian Sea, the Ministry of the Interior issued an order dated May 27/June 8, (two days after the appearance of cholera at Oozoun Ada) for the regulation of shipping on the Caspian Sea. By this order it was provided that on the appearance of cholera upon the Caspian littoral a sufficient number of medical men should be despatched to exercise supervision over vessels bound to places within Russian territory; that upon the appearance of cholera at a port the matter was to be at once reported to the Provincial Authorities at Baku and Astrakhan, and to the Chief of the Customs at Oozoun Ada; that all vessels proceeding to Russia were to undergo medical inspection, and if necessary disinfection before departure; that no soiled linen, clothing, or bedding should be taken on board; that upon the appearance of cholera on board ship, the patients with their bedding, &c., were to be removed to hospitals provided at Astara, Lenkoran, Baku, Petrofsk, Derbent, Guriev, Fort Alexandrovsk, and at Astrakhan on the Birischi Spit, and that a surgeon should be attached to every vessel carrying passengers.

From Oozoun Ada the western terminus of the Transcaspian railway where cholera had appeared on May 25/June 6 there is frequent communication by steamboat with the large and important town of Baku, situate 132 miles distant, on the western coast of the Caspian sea, the passage across occupying as a rule about 27 hours. Here the first case of cholera appeared on June 6/18, 12 days later than at Oozoun Ada, and 18 days after the first reported case in Russian territory at Kaachka.

Baku is one of the most important towns on the Caucasus, and has a population of upwards of 120,000 inhabitants. It is the chief centre of the Russian petroleum trade, and is the eastern terminus of the Trans Caucasian railway, which traverses the Southern Caucasus *passing through* Tiflis, and terminating at Batoum and at Poti on the

coast of the Black Sea. At Baku, cholera spread with great rapidity, and within a fortnight of its introduction, the daily number of fresh cases had risen to upwards of fifty. As a result, panic ensued, and the inhabitants fled by thousands.

The more speedy routes open to the fugitives were the steamers on the Caspian Sea from Baku to Astrakhan at the mouth of the Volga, and the Trans-Caucasian Railway already referred to, but thousands who could not avail themselves of either of these routes, fled from the town by road, to villages and towns in the Caucasus. A local journal* estimates the fugitives at 100,000, of whom 30,000 are said to have availed themselves of the Caspian steamers, 44,000 of the Trans-Caucasian Railway, and 26,000 escaped in other ways.

Taking the steamboat route first, it is to be noted that there is a fleet of trading steamers plying between Baku and Astrakhan, each having accommodation for some half-a-dozen passengers. During the panic, these boats are stated to have been crowded to an enormous extent, some carrying as many as 200, 400, and even 600 passengers.

The steamers from Baku call on their way to Astrakhan at Derbent and Petrofsk, and at the latter place 17 persons suffering from cholera were removed to hospital there from a ship from Baku on June 12/24, and between that date and June 18/30, eight died. On June 20/July 2 an inhabitant of Petrofsk was attacked, and died the same day.

The local authorities at Astrakhan upon receiving information of the outbreak of cholera at Baku, instituted a quarantine of 12 days for all vessels coming from that port, whether cholera had manifested itself on board or not, and it is stated that in consequence of this regulation, more than 3,000 passengers were detained at one time in the roads outside Astrakhan. It was reported in the public press† that "through "some unfortunate mismanagement, little care had been taken to supply "these persons with provisions, or even with fresh water, and that in "consequence the epidemic raged amongst them with fatal violence." Notwithstanding these local quarantine precautions, cases of cholera were reported to have occurred within the province of Astrakhan on June 12/24, though not in the town, which remained free until June 18/30, when eight cases and three deaths occurred in the town itself. As already stated, Astrakhan is situate at the mouth of the Volga, a river which in summer has a fleet of some 600 steamers by which all the traffic of the immense district extending from Astrakhan to Rybinsk and Tver, to the north of Moscow, is carried on. Upon this river numerous "observation" and "reception" points were established by the Government, at all of which medical officers were stationed, but notwithstanding every precaution, cholera appeared at Tsaritzin in the province of Saratof on June 14/26, in the town of Saratof on June 19/July 1, in the town and government of Samara on June 23/July 5, in the town and government of Simbirsk on June 24/July 6, and in the town and government of Kazan on June 25/July 7. The epidemic had thus travelled in a northerly direction along the course of the Volga, a distance of nearly 1,200 miles in 12 days. A few miles to the south of Kazan, the Volga is joined by its large tributary the River Kama, branches of which drain the three large governments of Viatka, Perm, and Ufa. The first case of cholera was reported to have occurred in the government of Viatka on June 27/July 9, in the town of Viatka on July 5/17, in the town and government of Perm on July 6/18, and in the government of Ufa on July 18/30. Following the course of the Volga

* "Le Kaspie," July 11/21, 1892.
† "Times," July 12, 1892.

In the annexed Map II. the progress of the disease, month by mc throughout European Russia and the Caucasus during the epidemi 1892 may be traced by distinctive colourings.

In addition to the railways and navigable rivers which have alre been referred to as means by which cholera was spread in Europ Russia, the elaborate network of canals connecting the rivers with another, and traversing the country from the Caspian Sea to Petersburg, must also be taken into account. It was by means of canal system that cholera was reported to have been introduced St. Petersburg.

From the following Table V., which is quoted, with one or two sli modifications, from Dr. Clemow's account of the epidemic in Russia, it be clear that the rapidity of the march of cholera from Astrakhan up Valley of the Volga and from Rostof-on-Don to the Governments l to the south and west of that town was much greater in 1892 tha the epidemics of 1830 and 1847.

TABLE V.

(*a.*) Showing the NUMBER of DAYS which elapsed between OCCURRENCE of the first recorded CASE of CHOLERA in ASTRAKI and that of the First Case in each of the several Towns name the Epidemic Years 1830, 1847, and 1892.

Name of Town.	1830.	1847.	1892.
Astrakhan - -	July 4/16 -	July 4/16 -	June 18/30.
Saratof - -	18 days later -	38 days later -	1 day later.
Samara - -	36 „ „ -	66 „ „ -	5 days later.
Simbirsk - -	43 „ „ -	70 „ „ -	6 „ „
Kazan - -	51 „ „ -	63 „ „ -	7 „ „
Nijni Novgorod - -	38 „ „ -	67 „ „ -	19 „ „

(*b.*) Showing the NUMBER of DAYS which elapsed between OCCURRENCE of the first recorded CASE of CHOLERA in ROST ON-DON and that of the First Case in each of certain To lying to the South and West of that Place.

Name of Town.	1830.	1847.	1892.
Rostof-on-Don - -	August 6/18 -	July 12/24 -	June 28/July
Kief - -	62 days later -	73 days later -	49 days later
Podolia - -	88 „ „ -	81 „ „ -	63 „ „
Volhynia - -	123 „ „ -	131 „ „ -	67 „ „

In Tables VI. and VII. are given the number of cholera attacks deaths recorded in the several Governments and large towns of Caucasus, to December 1/13, 1892, together with the rates per 10,00 the population.

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CHOLERA IN RUSSIA 1892.

MAP III.

5 10 15 20 25 30 35 40 45 50 55 60 65 70
Cholera Mortality per 10,000 of the Population. Under 1.
1 and under 15·2
15·2 " " 75
75 and upwards
[Mean Cholera Mortality of European Russia = 15·2 per 10,000 Population.]
Map shewing the incidence of Cholera Mortality on the several Governments of European Russia and the Caucasus during 1892.
Lapland
White Sea
Archangelsk
Gulf of Bothnia
Finland
65
60

The total cholera attacks recorded to December 1/13 in European Russia were 331,077 in number, of which 151,626, or 45·8 per cent., proved fatal. These figures are equivalent to an attack and to a death-rate of 33·1 and 15·2 per 10,000 of the population respectively. It will be seen that European Russia, as a whole, suffered much less proportionately than the Caucasus, and upon examination of the figures for the separate Governments it will be observed that the cholera death-rate in only one of the Governments of European Russia, namely, that of Astrakhan, exceeded the rate for the Caucasus taken as a whole. The Governments of European Russia which suffered the greatest incidence, both as regards cholera attack and cholera death, were those situate to the south-east and east, and of these the Governments riparian to the Lower Volga suffered higher rates than any other district, with the single exception of the Don Cossack Region. The cholera attack and death-rates recorded in the Lower Volga district per 10,000 of the population respectively, were as follows:—Astrakhan 249 and 125, Saratof 172 and 87, Samara 156 and 68, Simbirsk 103 and 44. In the Don Cossack Region attack and death-rates of 181 and 88 respectively were recorded. The only district in the west of Russia where exceptionally high figures were noted, was the Polish Government of Lublin, where the attack and death-rates were 54 and 21 per 10,000 respectively. The relative cholera mortality of the several Governments of European Russia and the Caucasus which obtained in 1892 are shown graphically in Map No. III.

From Table IX. it will be seen that as with the Governments, so with the large towns, the highest cholera attack and death-rates were recorded in those situate in the valley of the Volga. The following are the mortality rates per 10,000 of the population in the chief of these towns:—Astrakhan 316, Saratof 142, Samara 154, Simbirsk 139, Nijni Novgorod 126, and Orenburg 231. Rostof-on-Don in the Don Cossack Region suffered a higher mortality rate than any other town outside the Volga Provinces, namely, 209, whilst the town of Lublin had a death-rate of 158, Moscow and St. Petersburg escaping with the comparatively low rates of 15 and 13 per 10,000 respectively.

The place which the epidemic of 1892 holds with respect to previous cholera epidemics in European Russia may be gathered from the following Table X., in which the gross figures (the proportions to population not being available) with respect to the six previous epidemics in which the deaths from cholera have exceeded 100,000 are given.

TABLE X.

Showing TOTAL NUMBER of CHOLERA ATTACKS and DEATHS recorded in SEVEN EPIDEMICS in EUROPEAN RUSSIA in each of which the Number of Deaths exceeded One hundred thousand.

Epidemic Year.	Cholera Attacks.	Cholera Deaths.	Fatality per cent.
1831 - - -	466,457	197,069	42·2
1848 - - -	1,742,439	690,150	39·5
1853 - - -	260,134	104,338	40·2
1855 - - -	408,564	170,890	41·9
1871 - - -	327,670	126,516	38·3
1872 - - -	374,098	137,929	36·9
1892 - - -	331,077	151,626	45·8

From these figures it will be observed that the epidemic of 1892 ranks fifth as regards gross attacks, and fourth as regards deaths. It will also be noted that the fatality in 1892 was higher than that recorded in any one of the six previous epidemics in question.

For the purpose of comparing the relative mortality from cholera in those Governments of European Russia which suffered most in 1892 with the mortality recorded in the same Governments in the four previous great epidemics of 1853, 1855, 1871, and 1872, I have in Table XI. given the figures as regards the twelve Governments where the highest rates were recorded in 1892.

TABLE XI.

Name of Government.	Deaths from Cholera per 10,000 Population during				
	1892.	1872.	1871.	1855.	1853.
Astrakhan - - -	125	23	18	—	12
Don Cossacks - - -	88	7	6	—	—
Saratof - - - -	87	8	36	—	4
Samara - - - -	68	2	29	—	14
Simbirsk - - - -	44	1	5	—	7
Voronezh - - - -	45	1	50	3	2
Orenburg - - - -	39	2	47	—	8
Tambof - - - -	31	·02	67	—	5
Kursk - - - -	22	5	10	50	4
Lublin - - - -	21	7	—	?	12
Kazan - - - -	17	3	11	—	11
Ufa - - - -	17	·04	16	—	—

From this Table it will be seen that, with the exception of the Governments of Voronezh, Orenburg, and Tambof, where higher rates were recorded in 1871, and of Kursk, where a higher rate was observed in 1855, the mortality rates obtaining in 1892 were much in excess of those recorded with respect to each district in any one of the previous epidemics.

With the reasons for the exceptional incidence of cholera on particular localities this Report does not concern itself, but a few notes as to exceptional conditions which obtained in certain large areas may not be out of place.

Foremost among these it is to be observed that considerable stress has been laid upon the effect of the famine which prevailed in a large group of Governments in 1891. The Governments especially affected by the famine were 16 in number, and amongst them were included several of those which suffered exceptionally heavy rates of cholera mortality in 1892. But from Table XII., which I quote from Dr. Clemow, and which gives the statistics of the famine of 1891, and of the cholera epidemic of 1892, as to each of these Governments, it will be observed that whilst the cholera attack rate in the 16 distressed Governments was three times as heavy as that in the 44 Governments that did not suffer from famine, there does not appear to be much correspondence between

the statistics of the harvest yield and those of the incidence of cholera amongst the famine-stricken districts themselves. On the other hand, it is to be observed that higher rates of both attack and of death from cholera obtained in the Government of Astrakhan, in the Don Cossack Region, and throughout the Caucasus than in the famine-stricken districts, yet none of the districts named had been affected by the famine.

TABLE XII.

STATISTICS of the FAMINE of 1891 and the CHOLERA EPIDEMIC, 1892. [Clemow.]

Name of Government.	Per-centage of Harvest Yield of 1891 on average of Years 1886–90 (all Crops except Potatoes).	Harvest Yield per Head of Population* in Poods (all Crops including Potatoes).	Cases of Cholera per 10,000 Inhabitants, 1892.	Per-centage of Deaths to Cases of Cholera 1892.
Voronezh - -	24·8	1·61	89·4	50·2
Kazan - - -	40·7	3·59	38·0	44·4
Tambof - - -	44·6	9·06	73·3	42·7
Riazan - - -	45·0	9·50	9·0	51·0
Simbirsk - -	45·8	7·64	102·8	42·8
Penza - - -	49·0	9·79	48·3	45·4
Samara - - -	51·2	5·77	155·6	43·8
Saratof - - -	52·0	10·74	172·1	50·3
Orenburg - -	52·7	2·79	74·6	51·8
Ksk - - -	65·5	14·24	39·7	41·8
Tula - - -	66·8	21·13	8·4	29·0
Nijni Novgorod - -	70·0	12·32	28·0	44·0
Viatka - - -	70·5	12·81	34·3	45·3
Orel - - -	70·6	19·14	7·2	41·6
Ufa - - -	74·5	9·92	35·3	47·7
Perm - - -	75·0	14·07	15·0	48·7
16 distressed Governments - -	—	—	60·7	46·3
44 remaining Governments - -	—	—	19·7	41·4

Another factor which must be taken into account as having had considerable influence in increasing the intensity of cholera in a number of towns in the Volga Valley and elsewhere is to be looked for in the disgraceful anti-cholera riots which occurred in the early weeks after the invasion of European Russia by cholera. From an account given in the Official Gazette, it appears that the measures taken to prevent the spread of cholera gave rise to reports among the working classes that there were

* The weight of food grains required for each head of the population for all purposes (including distillation of alcohol) is reckoned at 14½ poods. One pood is equal to 36 pounds English.

in reality no cases of cholera; that the sick were conveyed to the hospitals without cause; that the reports with respect to the prevalence of the disease were promulgated for the benefit of the doctors themselves; that the drugs and disinfectants used poisoned people; and that patients who were still alive were sprinkled with quicklime and then buried. The first of these riots broke out at Astrakhan on June 21/July 3, three days after the commencement of the epidemic in that town. Here the mob attacked the hospital and after removing the patients, burnt the buildings to the ground, and murdered the doctors in charge. For five days the town was in the hands of the rioters, and as a consequence, the authorities were quite paralysed, and unable to carry out any measures for checking the epidemic, and order was not restored until troops had been brought into the place, and several of the rioters shot. How many people were attacked with cholera during this period is unknown, but it is known that upwards of three hundred persons died from cholera during the five days in question, and that when order was restored, the epidemic had become quite uncontrollable. Riots similar in character, with like results, took place at Saratof, Khvalinsk, Volsk, and several other places in the Valley of the Volga. In many instances the doctors and their assistants were maltreated or murdered, or only escaped the violence of the mob by secreting themselves in coffins, and it was not until the towns had been declared in a state of siege and troops marched into the districts that anything like order could be established. To the great firmness of General Baranoff, the Governor of Nijni Novgorod, the suppression of these riots was largely due, and a sentence passed by him on a would-be rioter is worth recording as an example of a punishment exactly fitting the offence.

A man named Kitaeff, who persistently asserted that there was no cholera at Nijni Novgorod, that the whole scare was got up by the doctors who poisoned the populace and then buried them alive, and who endeavoured to incite the mob to resistance, was arrested by order of the Governor, who passed the following sentence upon him :—

> "The citizen Kitaeff, having asserted that there is no cholera, and circulated various false stories concerning the treatment of patients, is hereby appointed as hospital assistant for three months in the floating cholera barge hospital, in order that he may have an opportunity of rectifying his opinions.
>
> (Signed) BARANOFF."

It is further recorded that in the Eastern Governments and in the Caucasus the poorer classes persistently refused to take any medicines whatever, and resented every form of medical aid. A characteristic example reported by Mr. Law, the commercial attaché to Her Majesty's Embassy at St. Petersburg, will suffice to indicate this feeling. Mr. Law was at the time making a tour of inspection in the district bordering upon the Volga. Amongst other places visited was the village of Grodny (7 miles from the Volga and 12 miles south of Volsk). This place, Mr. Law states, was one of the first to receive the epidemic, traced to the arrival from Baku of an old woman whose son had died of cholera, and who brought his effects with her. Grodny has between two and three hundred inhabitants. At the time of Mr. Law's visit 22 had died of cholera.

> "About ten days previously a doctor had been sent. The people asked him what he had come for. They said he could live in peace if he did not interfere. They are dying (in peace?); he is wasting his time (in peace), for they refuse all treatment."

The following characteristic examples of the diffusion of cholera by means of water are quoted verbatim from Dr. Clemow, as being of exceptional interest:—

"In the village of Ulybyshef (Vladimir Government) a labourer arrived on June 29th/July 11th from Kazan, where he had attended the funeral of his brother, who had died from cholera. Three days later he sickened with the disease in the morning and died in the same evening. The clothes he had worn remained in an outbuilding for a week. They were then washed in a stream from which the village drew its water supply. In a very short time cholera became epidemic throughout the village.

"In the government of Viatka, five villages situated along the banks of the same stream, were invaded by cholera. The infection was traced to the systematic washing of linen belonging to the early cases in the stream which provided the inhabitants of all the five villages with their drinking water. No sooner was this practice forbidden than the epidemic began to abate."

"In the village of Upper Moulla (Perm Government) an exactly similar relation of cause and effect was recorded. The linen of cholera patients was washed in a pond. From the same pond the inhabitants drew their supply of drinking water, with the result that cholera raged throughout the village. As in the last instance, as soon as the washing of linen in the pond was put a stop to, the number of cases of cholera in the village began to diminish.

"In the village of Borki (Samara Government,) lying on the River Samarka, the first case of cholera was that of a woman. After a short interval a peasant was seized with cholera upon a barque lying at anchor a short distance further down the river. The disease then became epidemic, solely among that portion of the population which drew its drinking water from the river. The remaining inhabitants, who drank water obtained from wells, remained free from the disease with but one or two exceptions.

"In Great Bereznikof, a village in the Simbirsk Government, an exactly parallel instance was recorded. Cholera attacked only that part of the village which drew its water supply from the River Kshi, whilst amongst the inhabitants of the other half of the village, whose drinking water was derived from wells, there was but a single case—that of a beggar woman to whom had been given some clothes from an infected house.

"In two villages in the Tambof Government, in each of which a dual water-supply existed, it was observed, in like manner, that cholera was confined to one portion of the inhabitants. In each instance it was found that this portion of the inhabitants drew its water-supply from a pond contaminated through the washing of linen of cholera patients. The rest of the village, supplied with well-water not so contaminated, did not furnish a single case of cholera.

"The part played by water in the diffusion of cholera was clearly illustrated at the beginning of the epidemic in St. Petersburg. It was found that the earliest cases were confined to the workmen in the large factories situated on the banks of that branch of the Neva known as the Great Nevka. The workmen were accustomed to drink water derived directly, without filtration or boiling, from this branch of the river—water which at all times is charged with much organic matter (14 parts in 100,000), and which produces gastro-intestinal catarrh in all persons unaccustomed to its use. It was at once arranged that water should be supplied to the workmen from the town waterworks, and that this water should be filtered or boiled before drinking. The effect of the change in the water-supply was immediate, and there was no further spread of cholera in that part of the city.

"Another instructive case was furnished by one of the St. Petersburg prisons. A prisoner who had been in solitary confinement for more than

a month was suddenly seized with all the symptoms of cholera. Bacteriological and post-mortem evidence confirmed the diagnosis. All the prisoners were supplied with boiled water, and for a time the source of infection remained an enigma, which was only solved by the discovery that the deceased had drunk a quantity of unboiled water provided him for washing purposes. Steps were immediately taken to furnish all the other prisoners with boiled water for whatever purpose required."

Whilst cholera had spread throughout the Caucasus and European Russia in the manner already described, it had likewise become diffused over a large portion of the Russian territory in Central Asia and in Siberia, and to this diffusion I now propose to refer briefly.

It has already been noted that Kaachka was invaded by cholera on May 31/June 12, and that the disease had reached Oozoun Ada on the eastern shore of the Caspian Sea on May 25/June 6, and that at that time it had not apparently invaded the intermediate stations on the Trans-Caspian Railway. On June 10/22, however, several cases of cholera were reported to have taken place amongst some troops who had recently marched from Merv to camp in the neighbourhood of Askhabad. On that date it was stated that 4 men had died of cholera; that 9 were seriously ill with choleraic symptoms, that 23 were suffering from diarrhœa, and that 2 children in Askhabad itself had been attacked by cholera.

The town of Askhabad, which is the capital of Trans-Caspia, has a population of some 13,000 persons. On June 14/26 and 15/27, 7 cases and 1 death from cholera were reported there, and during the same period there were 13 cases and 5 deaths at the camp above referred to. On June 18/30 the disease appeared amongst the Turkoman population living in the aoul of Askhabad, and in four days there were 24 cases with 11 deaths. During the month of July the number of attacks was comparatively small, but at the beginning of August a great outbreak occurred, to which I shall have to refer later.

On June 8/20 a conductor of one of the trains running eastward from Kaachka was taken ill on the journey and removed at Bokhara station with all the symptoms of cholera. The city of Bokhara itself apparently escaped until much later, and it was not until July 31/August 12 that cases were reported to have occurred there. This may perhaps be attributed to the vigorous sanitary measures taken there towards the end of May, when it was reported that the Ameer of Bokhara, at the instigation of the Russian authorities, had directed the thorough cleansing of his capital, a measure which produced considerable murmuring and agitation amongst his subjects; in fact, the opposition was so great that the resident authorities were unable to cope with it, and the Ameer himself had to be sent for from his country seat. On his arrival His Highness at once commanded the execution of every subject who had failed to carry out the new sanitary regulations within one week!

The exact dates when the several districts and towns in Central Asia were invaded are not to be ascertained, but it appears from the official returns that the places earliest affected in Russian Turkestan were Jizak and Chinaz, which lie between Samarkand and Tashkent, both of which were invaded between May 31/June 12 and June 10/22. Samarkand is said to have been invaded on May 31/June 12, whilst at Tashkent, the capital of Russian Turkestan, cases of cholera were recorded to have occurred on June 7/19. Here the disease spread rapidly and extended throughout the Provinces of Syr-Daria and

Ferghana, reaching the neighbouring Provinces of Semiretchinsk and Akmolinsk on June 17/29 and June 27/July 9 respectively.

Thus, during the months of June and July cholera had become diffused throughout the southern provinces of Asiatic Russia, and its further extension to the more northernly provinces cannot be traced step by step. It may, however, be noted that the Port of Gurief, situate at the northern extremity of the Caspian Sea, at the mouth of the River Ural, was invaded by cholera on July 8/20, the disease being there introduced by travellers from Astrakhan, and from this place it spread throughout the province of Uralsk and thence to that of Turgai, which lies immediately to the east of Uralsk, where the first cases were reported on July 24/August 5.

In the meantime the disease had appeared at Omsk on July 14/26, at Tomsk on July 12/24, at Tobolsk on July 17/29, finally reaching Irkutsk and Yeniseisk on August 2/14 and August 4/16 respectively.

Some idea of the extent of territory invaded and of the populations exposed to the infection of cholera throughout the Russian Empire may be gained from a study of the following Table XIII., compiled by Dr. Grebentschikoff, which shows the area and population of the districts in which cholera was present during each of the months from May to November of the year 1892.

TABLE XIII.

Showing the AREA and POPULATION of the DISTRICTS in the RUSSIAN EMPIRE in which CHOLERA was present during each of the Months May–November (Old Style) 1892.

Month.	Area in Square Versts.	Population.
May - - - -	Over 484,000	700,000
June - - - -	„ 2,753,000	15,286,000
July - - - -	„ 7,271,000	68,466,000
August - - - -	„ 7,645,000	77,895,000
September - - - -	„ 7,868,000	87,346,000
October - - - -	„ 6,965,000	87,725,000
November - - -	„ 1,662,000	69,787,000

In Tables XIV. and XV. are given the number of attacks and deaths from cholera recorded in the several provinces and large towns of Central Asiatic Russia and of Siberia from the commencement of the epidemic to December 1/13, 1892, together with the rates per 10,000 of the population.

Table XIV.

Statistics of the Cholera Epidemic in the several Provinces of Central Asiatic Russia and of Siberia from its Commencement to December 1/13, 1892.

Name of Government or Province.	Date of Occurrence of first recorded Case of Cholera.	Total recorded Cholera.		Rate per 10,000 of the Inhabitants.		Percentage of Deaths to Attack. "Fatality."	Dates to which Statistics are carried when they do not terminate on Dec. 1/13.
		Attacks.	Deaths.	Attacks.	Deaths.		
Trans-Caspia	May 19/31	2,800	1,517	40·0	21·7	54·0	
Samarkand	May 31/June 12	14,960	7,480	213·9	106·9	50·0	19 weeks.
Syr-Daria	June 7/19	12,455	8,785	103·8	73·2	70·5	20 „
Ferghana	June 8/20	19,320	9,610	241·5	120·1	50·0	20 „
Semiretchinsk	June 17/29	46	28	0·7	0·4	60·9	19 „
Akmolinsk	June 27/July 9	1,717	891	34·3	17·8	52·0	18 „
Tomsk	July 12/24	4,697	2,272	34·5	16·7	48·3	7 „
Uralsk	July 8/20	6,138	3,121	102·3	52·4	50·8	Nov. 9/17.
Tobolsk	July 17/29	26,301	12,729	186·5	90·2	48·4	15 weeks.
Turgai	July 24/Aug. 5	296	167	7·4	4·2	56·5	10 weeks.
Irkutsk	Aug. 2/14	23	8	0·7	0·2	28·6	2 „
Yeniseisk	Aug. 4/16	71	28	1·4	0·5	39·5	Oct. 10/22.
Semipalatinsk	Aug. 12/24	370	205	6·1	3·4	55·5	11 weeks.
Central Asia and Siberia.	—	89,199	46,841	—	—	—	

Table XV.

Statistics of the Cholera Epidemic in the Principal Towns invaded in Central Asiatic Russia and in Siberia during 1892.

Names of Towns.	Date of Occurrence of first recorded Case of Cholera.	Total recorded Cholera.		Rates per 10,000 of the Inhabitants.		Percentage of Deaths to Attack. "Fatality."	Period for which the Statistics are given.
		Attacks.	Deaths.	Attacks.	Deaths.		
Tashkent	June 7/19	1,879	1,640	184	136	87·3	10 weeks.
Tomsk	July 12/24	1,388	809	247	203	58·4	11 „
Omsk	July 14/26	1,434	768	264	138	53·6	12 „
Tobolsk	July 17/29	490	285	293	180	58·2	12 „
Uralsk	July 23/Aug. 4	478	147	184	57	30·8	10 „
Semipalatinsk	Aug. 12/24	370	205	231	128	55·4	5 „

From Table XIV. it will be observed that the total number of attacks from cholera recorded in Asiatic Russia in 1892 were 89,199, and that of these 46,841, or 52·5 per cent., proved fatal. The highest rates of mortality occurred in the provinces of Ferghana (120·1), Samarkand (106·9), Tobolsk (90·3), Syr-Daria (73·2), and Uralsk (52·4).

From Table XV. it will be seen that several of the chief towns invaded by cholera in Asiatic Russia suffered heavy mortality rates from cholera, for example, Tomsk 202, Omsk 138, Tashkent 135, and Tobolsk 130 per 10,000 of the population.

In Asiatic Russia as in the Caucasus and European Russia, the relation of the incidence of cholera to the purity of the water-supply was frequently observed. Two instructive examples of this are given in a despatch* of the United States Consul-General, Mr. Heenan, to his Government, dated October 11th, 1892.

The first is as follows:—

> "At Samarkand three regiments of infantry were encamped side by side, on a level plain close beside a stream of water. The Colonel of one of these regiments took the most extraordinary pains to prevent his men from being attacked with cholera, and he succeeded. In the first place, he caused every article in camp to be thoroughly cleansed with hot water, and then disinfected. He compelled his men to bathe every day in water that had been boiled, and a guard was constantly maintained, whose duty it was to keep the soldiers from drinking the river water, and to carry out the Colonel's instructions. The result was, that not a single case of cholera occurred in the regiment, while the other two regiments that were camped alongside lost over a hundred men from cholera. In these regiments the ordinary precautions were taken, but no such measures were adopted as I have mentioned above."

The second example refers to the outbreak to which I have already referred as having taken place at Askhabad in August. It is as follows:—

> "At Askhabad the cholera had almost disappeared early in August, and the event was celebrated with much rejoicing on the anniversary of the Emperor's name-day, which occurs in that month. The Governor-General gave a dinner, to which he invited a numerous company, and the various regiments were granted extra rations, that they might rejoice on the occasion. The day which began so auspiciously amidst general rejoicing, was destined to have an ending which has no parallel in history. Of the numerous guests who attended that dinner, one half died within twenty-four hours. A military band of about fifty men who played during that fatal dinner lost forty of their number with cholera, and only ten of the men reached camp that night. One regiment lost half its men and nine officers ere the sun rose the following morning, and within forty-eight hours thirteen hundred people died with cholera. The cause of this outbreak was clearly traced to a small stream of water which supplied the town. Four days previous the authorities were informed that cholera had broken out at a small Turkoman village situated on the banks of this stream, about four miles from Askhabad. The inhabitants of this village were ordered to move their kibitkas (tents) several miles back on the hills, which they did. On the day previous to the

* Weekly Abstract of Sanitary Reports issued by the Supervising Surgeon-General. M. H. S., Washington, 1893, Vol. vii., pp. 721, 722.

re-appearance of the cholera at Askhabad, a very heavy rain-storm occurred, which washed the banks of the river and swept refuse and other matter from the abandoned village into the stream, and this matter was carried by the water into the city, and distributed to all parts of the town by the numerous open canals through which the inhabitants were supplied with water. It was this contaminated water which caused the re-appearance of the epidemic and the frightful mortality which followed. The population of Askhabad was not more than 13,000 of which 10 per cent. died within forty-eight hours."

Turkey-in-Asia.

I have already referred to the fact that the remains of the cholera epidemic which had been spread along the pilgrim routes in 1890–91, still existed in the Vilayets of Damascus and Beirut in Syria, and in those of Hedjaz and Yemen in Arabia at the beginning of the year 1892, but as regards the two first-named districts, the epidemic was reported to have terminated before the end of the first quarter of the year, whilst it still, as will be seen in the sequel, existed in Arabia throughout the whole of the year. As the diffusion in the Northern Provinces of Asiatic Turkey in 1892 was quite independent of that in Arabia, it will be convenient to describe the march of cholera in these Northern Provinces in the first instance, leaving the consideration of the diffusion in Arabia to a later stage of this report.

Northern Provinces of Turkey-in-Asia.

Early in July an outbreak of choleraic disease was reported to have occurred at St. Jean d'Acre in Syria, and in consequence a medical commission was despatched from Beirut to inquire into the matter. The commission reported that the disease was cholera nostras, produced by the opening of a foul drain; that it was confined to the quarter of the town in which the drain was situate, and that it showed no signs of spreading. In all, 17 deaths occurred, the last on July 28th, after which no further cases were reported.

On July 27th, cholera appeared in the quarantine station at Platana, in the province of Trebizond, amongst travellers who had come from Batoum. Between July 27th and September 4th it was reported that 114 cases of cholera had occurred amongst persons undergoing quarantine at Platana, and that of this number 93 had died, including 4 soldiers of the sanitary cordon. The first case reported in the town of Platana took place on August 4th, and between that date and January 21th, 1893, 47 persons were attacked (including 4 soldiers of the sanitary cordon), and of these 27 died. The town of Trebizond was first invaded on September 8th, and between that date and September 13th 10 cases of cholera, of which 7 proved fatal, occurred. The disease, however, did not become epidemic in Trebizond until after October 30th.

In the meantime another importation of cholera into Asia Minor had taken place. On August 31st a man coming from Kars, after a stay of 10 days in the lazaretto of Kerelek, on the Russo-Turkish frontier, was attacked by cholera, and died at Hassan-Kali, near Erzeroum, in his own home. The local authorities took immediate steps, with the object of securing the disinfection of the house where the death occurred, and the separation of the healthy inhabitants of the village from the companions of the deceased, upon which persons a quarantine of 15 days was imposed. In spite of these precautions, however, 3 more deaths from cholera took place at Hassan Kali on September 3rd, and on

September 5th, official notification was given that cholera had made its appearance at Anzelek, four hours distant from Hassan Kali and from Erzeroum respectively. In the following week isolated cases were reported to have occurred in several villages in the Vilayet of Erzeroum; from September 1st to September 23rd, 92 deaths from the disease being recorded. The first death from cholera in the city of Erzeroum was said to have occurred on September 20th, after which date the disease spread there rapidly. Other towns and villages in this Vilayet became infected, the number of cases officially reported to have occurred throughout the Vilayet from September 1st, 1892, to January 12th, 1893, being 8,095, of which 4,042 proved fatal. These cases and deaths were distributed in the several districts of the Vilayet as shown in the following Table:—

Table XVI.

Statistics of Cholera in the Erzeroum Vilayet from September 1st, 1892, to January 12th, 1893.

Name of District.	Estimated Population.	Recorded Cholera.		Rates per 10,000 of Population, of Cholera.		Per-centage of Deaths to Attacks. "Fatality."
		Attacks.	Deaths.	Attacks.	Deaths.	
Erzeroum - -	45,000	690	351	151	78	51·6
Passin - - -	47,000	2,293	1,652	488	351	72·2
Rhines - - -	26,000	244	160	94	62	65·6
Tardjan - - -	27,000	190	93	70	34	49·0
Ova - - -	70,500	1,531	780	217	111	51·0
Tortum - - -	52,000	916	512	176	98	55·9
Ignir - - -	36,380	339	159	93	44	46·9
Bajazid - - -	52,474	412	163	79	31	39·6
Erzingian (troops) -	26,000	692	286	279	116	41·6
Erzingian (civilians) -		34	16			
Baiburt - - -	58,000	764	376	132	65	49·2
Totals - -	440,354	8,095	4,548	184	103	56·2

The figures in the above Table as to cholera attack and cholera death are probably very much below the mark, owing to the fact that the Mahommedan inhabitants are stated to have avoided reporting deaths to the authorities, and to have buried their dead by night in their court-yards and gardens. Her Majesty's Consul at Erzeroum estimates the deaths from cholera in that city alone to have numbered 2,500. But accepting the official figures as reliable, they are equivalent to attack rates and death rates for the whole Vilayet of 184 and 103 per 10,000 of the population respectively.

On October 30th, cholera was re-introduced into Trebizond by artillerymen who had marched there from Erzeroum, and amongst whom several men had been attacked by cholera during their march. On this occasion the disease spread rapidly in Trebizond, with the result that between October 30th, 1892, and January 9th, 1893, 390 persons were reported as having been attacked by cholera, and of these 230 died; numbers equivalent to attack and death rates of 108 and 63 per 10,000 of the population respectively.

The following Table which is taken from a very complete series included in a despatch from Her Majesty's Consul at Trebizond, shows the incidence of cholera on the several classes of the community living in Trebizond.

Table XVII.

Statistics of Attacks and Deaths from Cholera in the several Communities living at Trebizond for the period October 30th, 1892, to January 9th, 1893.

Community.	Inhabitants.	Cholera Attacks.					Cholera Deaths.				
	Number.	Males.	Females.	Children under 12 years of age.	Total.	Rate per 10,000 of the population.	Males.	Females.	Children under 12 years of age.	Total.	Rate per 10,000 of the population.
Turks - - -	22,000	121	72	34	227	103	70	42	23	135	61
Greeks - -	8,000	48	52	15	115	143	31	29	7	67	83
Armenians - -	6,000	21	19	8	48	80	12	11	5	28	46
Total -	36,000	190	143	57	390	108	113	82	45	230	63

From the above Table it will be seen that the largest proportion both of attacks and deaths occurred amongst the Greek population, whilst of the Turkish children attacked, all with one exception died.

On November 13th, the town of Van was reported to have been invaded by cholera imported from Persia, and from a despatch received at the Foreign Office from Her Majesty's Vice-Consul at Van, it would appear that up to December 8th, 150 deaths from cholera had been officially reported to have occurred there, but the Vice-Consul states that the number of deaths was doubtless greater, as many of the returns had not been regularly handed in, and according to common report there had been between 900 and 1,000 cases. In a despatch dated December 15th, Her Majesty's Vice-Consul reported that the epidemic had apparently ceased in the city of Van, but that numerous cases had occurred in the villages of the Sub-District of Havatzor, and that of these a few had been fatal. As regards Van, no further official figures are available.

The precautions adopted to prevent the spread of cholera in the districts referred to above appear to have been practically limited to the formation of sanitary cordons, firstly, on the Turko-Persian and Turko-Russian frontiers, and secondly, around each town and village as it became infected. It is, however, stated that little difficulty was experienced by travellers in penetrating these cordons so long as they took byepaths and not main roads, as the number of troops was not sufficient to do more than close the main thoroughfares, and further, that they were especially lacking in cavalry. It was also a matter of common observation that in many instances cholera was introduced into fresh districts by soldiers employed in the work of "protection." From a despatch by Her Majesty's Consul at Erzeroum it would appear that the Ottoman Government began by forbidding the sale and use of injurious and over-ripe fruit, that they ordered the isolation of infected houses, the disinfection or destruction of infected bedding and clothes, and the

sprinkling with quicklime of the graves and corpses of those who died of cholera, but upon these measures being resisted by the Mahommedan inhabitants on religious and economic grounds, the local government weakly gave way on all points. In the same despatch Mr. Consul Fitz-Maurice points out the illogical way in which quarantine was imposed and the uselessness of the measures adopted to prevent the spread of cholera, in the following words :—

"When cholera was raging in the Erzeroum Vilayet and comparatively "mild in the Caucasus, arrivals from the Caucasus were forced to "undergo a ten days quarantine. The same was the case with arrivals "from Persia at a time when both Persia and Turkey were con- "taminated. Similarily when the Vilayets of Trebizond and Erzeroum "were both infected, departures from Erzeroum, to Trebizond had to "undergo eleven days quarantine before leaving this Vilayet (Erzeroum) "whilst arrivals from infected Trebizond underwent quarantine before "entering the infected Vilayet of Erzeroum. The same double quarantine "was imposed on travellers between Van and Erzeroum when cholera "existed in both Vilayets. The result was that the Persian transit trade "almost entirely ceased, as did also the local trade. This hampering of "commerce has helped very materially to produce the scarcity and misery "that now prevail in this district. The prices of fodder have tripled, "while the necessaries of life, bread, &c., have more than doubled. "These quarantines entailing such losses commercially have had no "compensating advantages in checking the advance of cholera, and their "inefficiency may, I think, be attributed apart from the general question "of the inefficiency of quarantines to the fact that some of the quarantine "officials were not inaccessible to bribery."

France.

On April 4th* an inmate of the Maison Departementale of Nanterre† was attacked with choleraic symptoms and died in 24 hours. Further cases of cholera appeared shortly afterwards amongst persons employed in the same workshop. The person attacked had been absent on leave some days previously.

On April 6th another inmate of the institution, living in the old men's ward, who had not and could not have had any contact with the case noted above, was on return from a day's absence seized with violent choleraic symptoms and died in six hours in the ward, it not having been found possible to take him to the infirmary. In his ward in the space of the next few days, no less than 25 other persons were attacked by cholera, all of whom, with one exception, died.

The disease having thus become established in the Maison de Nanterre continued to spread there slowly without however any further serious epidemic outburst until October, causing in all 73 attacks of which 59 proved fatal; figures equivalent to an attack rate of 204·4 and a death rate of 164·9 per 10,000 of the inmates of the institution. As to the origin of the disease at the Maison de Nanterre several explanations have been offered (*a*) that it was due to a recrudescence of the cholera

* The dates given in this account are taken from the official report published by the Prefect of the Seine with regard to the epidemic in the Department of the Seine (see note*, page 117, *ante*). From official figures recently obtained from the Ministry of the Interior it would appear that a death due to cholera occurred on March 31st in the Maison-de-Nanterre, but as no report has yet been published I can only state the fact here without comment.

† The Maison Departementale de Nanterre is an establishment situate in the commune of Nanterre, one of the western suburbs of Paris. This institution serves many purposes, having the character partly of a workhouse, partly of a prison, besides serving as an asylum for aged and infirm beggars.

of 1884; but as to this it is stated that the establishment was not invaded by cholera in that year; (*b*) that it may have been due to an indirect importation by means of rags from Tonquin or other infected country, as there was a workshop in the establishment where worn-out clothing was cut up for re-manufacture; but as to this it is stated that the first person attacked had had no communication with the rag shop or with those who worked in it prior to this attack, and that the second person attacked did no work; and (*c*) that the disease did not take its origin in the institution, but was brought in from outside. In support of this last theory it is stated that both the first cases which occurred at the Maison de Nanterre were attacked after their return from leave of absence, and that at a period almost identical at places in the environs of Paris distant from each other and from the Maison de Nanterre well defined cases of cholera had occurred. The cases referred to appeared on April 8th at Neuilly, on the same date at St. Denis (à la Plaine), and on April 11th at Puteaux and at Suresnes. It will be observed on reference to Map IV. that all these Communes are situate to the north-west of Paris. From the official records it appears that the use of Seine water was the only circumstance which could be discovered to be common to all the cases of the initial period, cases remote from one another, in different communes, yet attacked at practically the same time.

During the month of April, the incidence of cholera was confined to the communes of the north-west suburbs of Paris situate on the Seine, namely, Nanterre, Neuilly, Puteaux, Île St. Denis, Courbevoie, St. Denis, Colombes, Levallois-Perret, Suresnes, and St. Ouen.

In May cholera appeared at Clichy and at Asnières, communes also in the north-western suburbs of Paris, and a few isolated cases were recorded to have occurred in the city of Paris itself.

In June the occurrence of cholera was recorded at Boulogne-sur-Seine, Montreuil, Maisons-Alfort, Aubervilliers, Villemomble, Issy, Gennevilliers, Gentilly, La Courneuve, and Pantin; at the same time the disease slowly progressed in Paris. The march of cholera month by month in the Department of the Seine is illustrated in Map IV., and from a consideration of this map it will be observed that during the first three months during which the presence of cholera was noted, the incidence of the disease was with the exception of isolated outbreaks at Montreuil and Maisons-Alfort, confined to communes situate to the west, north-west, or north of Paris. To the signification of this limitation of the disease, reference will be made later in this report.

In July cholera began to assume epidemic proportions in Paris, and it continued to prevail there until the end of the year. During the months of July, August, and September, the disease spread to the southern, eastern, and north-eastern suburbs of Paris; there was, however, little tendency to epidemic extension in these districts, and a considerable number of communes in these suburbs entirely escaped attack.

In Table XVIII. will be found the statistics of the cholera epidemic recorded in the environs of Paris in the Department of the Seine during 1892, and in Map V. the relative mortality from cholera recorded in the several communes is shown graphically.

Upon an examination of Table XVIII. and of Map V., it will be observed that whilst the mean cholera death-rate for the whole Department was six per 10,000 of the population, a mortality in excess of this mean was recorded in the western, north-western, and northern suburbs, whilst the mortality observed in the communes situate to the south and south-east of Paris, was, with one or two trifling exceptions, below the mean of the Department.

CHOLERA IN THE ENVIRONS OF PARIS.

Map IV.

Cholera in Paris and its Environs 1892.

Map V.

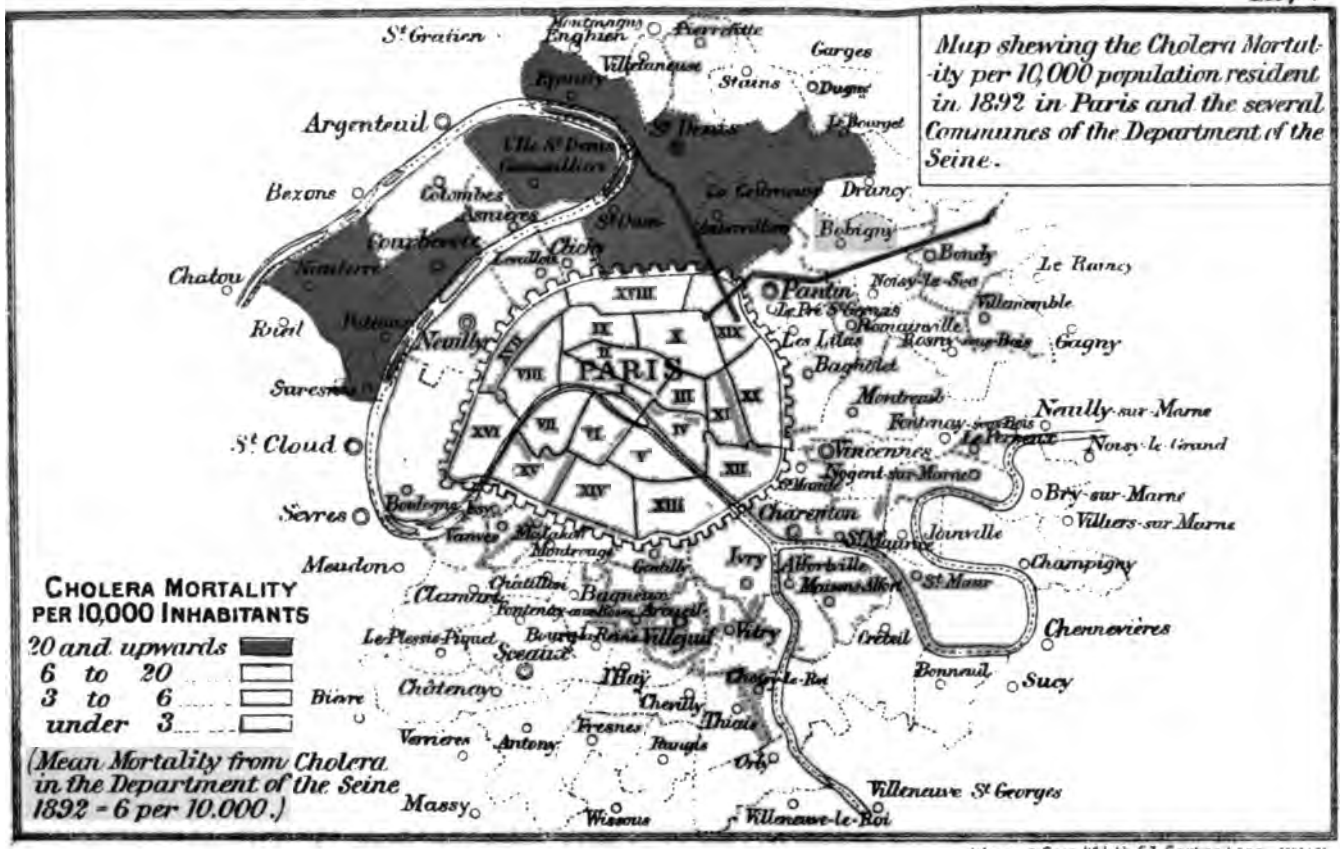

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Table XVIII.

Statistics of Cholera in the Environs of Paris, 1892.

[*In this and in subsequent Tables, rates taken on single attacks or single deaths respectively are placed in square brackets.*]

Commune.	Population. Census 1891.	Recorded Duration of Cholera.	Total Deaths from Cholera recorded in 1892.	Cholera Death-rate per 10,000 Population 1892.
Nanterre (*Maison de*)	3,571	April 4 — Oct. 9	59	*164·9*
Neuilly - -	29,444	„ 8 — „ 5	32	*10·8*
Ile-Saint-Denis -	2,268	„ 10 — Sept. 29	9	*39·7*
Puteaux - -	17,646	„ 11 — Nov. 5	53	*30·0*
Suresnes - -	8,404	„ 11 — Oct. 11	20	*23·8*
Courbevoie - -	17,597	„ 14 — „ 1	38	*21·6*
Saint-Denis - -	50,992	„ 17 — Nov. 30	104	*20·4*
Vanves - -	6,815	„ 18 — Sept. 16	3	*4·4*
Colombes - -	18,918	„ 18 — Oct. 31	21	*11·1*
Levallois-Perret -	39,857	„ 20 — „ 10	68	*17·1*
Nanterre (town) -	6,393	„ 24 — Sept. 15	9	*14·0*
Saint-Ouen - -	25,969	„ 27 — Oct. 23	142	*54·6*
Clichy - -	30,698	May 3 — Nov. 11	46	*14·2*
Asnières - -	19,575	„ 24 — „ 2	25	*12·7*
Boulogne-sur-Seine -	32,569	June 1 — Oct. 27	31	*9·5*
Montreuil-sous-Bois -	23,986	„ 6 — Dec. 13	19	*7·9*
Maisons-Alfort -	7,853	„ 7 — Aug. 28	4	*5·1*
Aubervilliers - -	25,022	„ 11 — Oct. 13	134	*53·9*
Villemomble - -	3,725	„ 18 —	1	[*2·6*]
Issy - - -	12,830	„ 18 — Sept. 10	7	*5·4*
Pantin - - -	21,847	„ 23 — Dec. 17	39	*17·8*
Gennevilliers -	5,837	„ 27 — Sept. 28	13	*22·2*
Gentilly - -	15,017	„ 29 — „ 30	7	*4·6*
Malakoff - -	9,144	July 5 —	1	[*1·1*]
Le Pré-Saint-Gervais -	8,138	„ 6 — Sept. 4	2	*2·4*
Le Bourget - -	2,258	„ 7 — Aug. 6	6	*26·6*
Epinay - -	2,591	„ 7 — „ 15	7	*27·0*
Saint-Maur - -	17,333	„ 8 — „ 8	4	*2·2*
La Courneuve -	1,542	„ 12 —	6	*38·9*
Dugny - -	611	„ 16 —	1	[*16·4*]
Pierrefitte - -	1,824	„ 25 — Aug. 4	2	*10 9*
Charenton - -	15,306	„ 28 — Oct. 3	5	*3·2*
Alfortville - -	7,984	Aug. 2 — Sept. 22	3	*3·7*
Choisy-le-Roi -	8,449	„ 7 — Aug. 24	2	*2·4*
Saint-Maurice -	6,653	„ 15 — „ 29	3	*4·5*
Ivry - - -	22,357	„ 23 — Oct. 16	7	*3·1*
Vitry-sur-Seine -	7,161	„ 24 — „ 4	2	*2·7*
Romainville - -	2,106	„ 24 — Sept. 26	2	*9·5*
Bondy - -	3,638	„ 27 — „ 6	5	*1·4*
Bagnolet - -	6,124	„ 27 —	1	[*1·6*]
Bobigny - -	1,540	Sept. 1 —	2	*13 0*
Nogent-sur-Marne -	8,399	„ 4 — Oct. 5	2	*2·4*
Arcueil - - -	6,088	„ 22 — „ 3	1	[*1·6*]
Le Perreux - -	6,699	„ 23 —	1	[*1·4*]
Villejuif - -	4,294	Nov. 1 —	1	[*2·3*]
Vincennes - -	24,626	„ 10 — Dec. 11	2	*0·4*

It will further be noted that the cholera mortality was exceptionally high in a group of communes situate directly to the north of Paris, and comprising Aubervilliers (53·9), Saint-Ouen (54·6), Saint-Denis (20·4), Ile-Saint-Denis (39·7), Epinay (27·0), and La Courneuve (38·9), and that as regards a second group situate to the west of Paris, very high

rates of cholera were also recorded, though in the aggregate to a less degree than in the northern group.

This western group comprises the communes of Nanterre (65·2 including the "Maison de Nanterre"), Puteaux (30·0), Suresnes (23·8), Courbevoie (21·6), Colombes (11·1), Asnières (12·7), Gennevilliers (22·2), Clichy (14·2), Levallois (17·1), Neuilly (10·8), and Boulogne-sur-Seine (9·5).

Of the communes situate in the southern suburbs of Paris, not one suffered an excessive incidence of cholera, whilst of those in the eastern suburbs, with the exception of one or two communes where the population was too small to give rates of value, excessive cholera mortality was observed in Pantin (17·8) only.

In view of the observed localisation of cholera incidence in the suburbs of Paris, certain circumstances connected with their water supply become of interest. From the official report already referred to, it appears that the communes of the suburbs of Paris derived their water-supply chiefly from either the River Seine or the River Marne, whilst a few were supplied with water from the River Oise, or from private wells.

The communes receiving their water supply from the Seine may be divided into three groups according to the situation of the intake of the waterworks, as follows: (*a.*) Communes, 29 in number, supplied with water by works the intakes for which are situate *above* Paris, at Choisy-le-Roi, Alfortville, and Port à l'Anglais. These communes are all situate to the south of Paris. (*b.*) Communes, 11 in number, supplied with water by works, the intakes of which are situate *below* Paris, at Boulogne, Suresnes, and Neuilly, but *above* the outfall of the Parisian main sewer. The communes supplied from this source are situate to the west and north-west of Paris, and comprise Boulogne-sur-Seine, Neuilly, Levallois-Perret, Clichy, Gennevilliers, Colombes, Asnières, Courbevoie, Nanterre, Puteaux, and Suresnes. (*c.*) Communes, 4 in number, supplied with water by works situate at Saint-Denis, the intakes for which are *below* Paris and also *below* the outfall of the Parisian main sewer. This communes are situate to the north of Paris and comprise Saint-Ouen, Saint-Denis, Epinay, and L'Ile-Saint-Denis. In addition to these, the commune of Aubervilliers received its supply from the same works during the summer months of 1892, the Seine water at that time having been substituted for that of the Marne. As will be readily understood, the water supplied to the first of these three groups is the least polluted, that of the third group the most polluted, while that of the second group occupies a midway position.

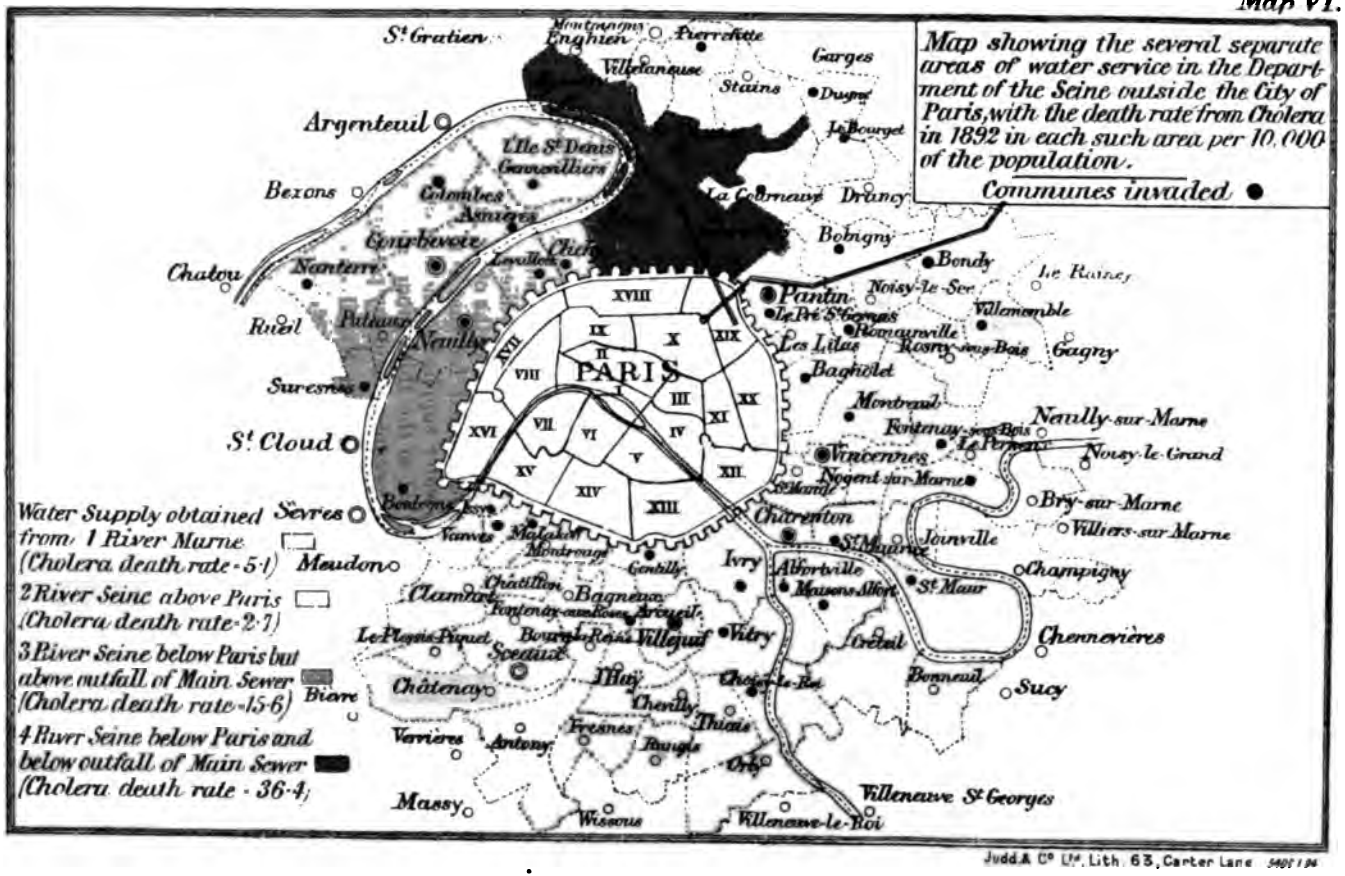
The water of the Marne taken at Neuilly-sur-Marne, St. Maur, Nogent-sur-Marne, Chennevières, La-Varenne, Bonneuil, and Créteil supplies 22 communes, situate to the east of Paris. The communes obtaining their water supply from wells and from the Oise are situate to the north-east of Paris. The distribution of the water supply to the communes of the Seine is illustrated graphically in Map VI.

Upon an examination of the records of the cholera mortality in 1892 in the several groups some very noteworthy results are obtained. In the group supplied with Seine water taken from above Paris, which comprises a total population of 170,137, there were 47 deaths from cholera, equivalent to a rate of 2·7 per 10,000 of the population. In this group 16 of the 29 communes entirely escaped invasion from cholera.

In the group supplied with Seine water taken from the river between Paris and the outfall of the main sewer, which comprises a total population of 230,975 there were 356 deaths from cholera, equivalent to a rate

Cholera in the Environs of Paris 1892.

Map VI.



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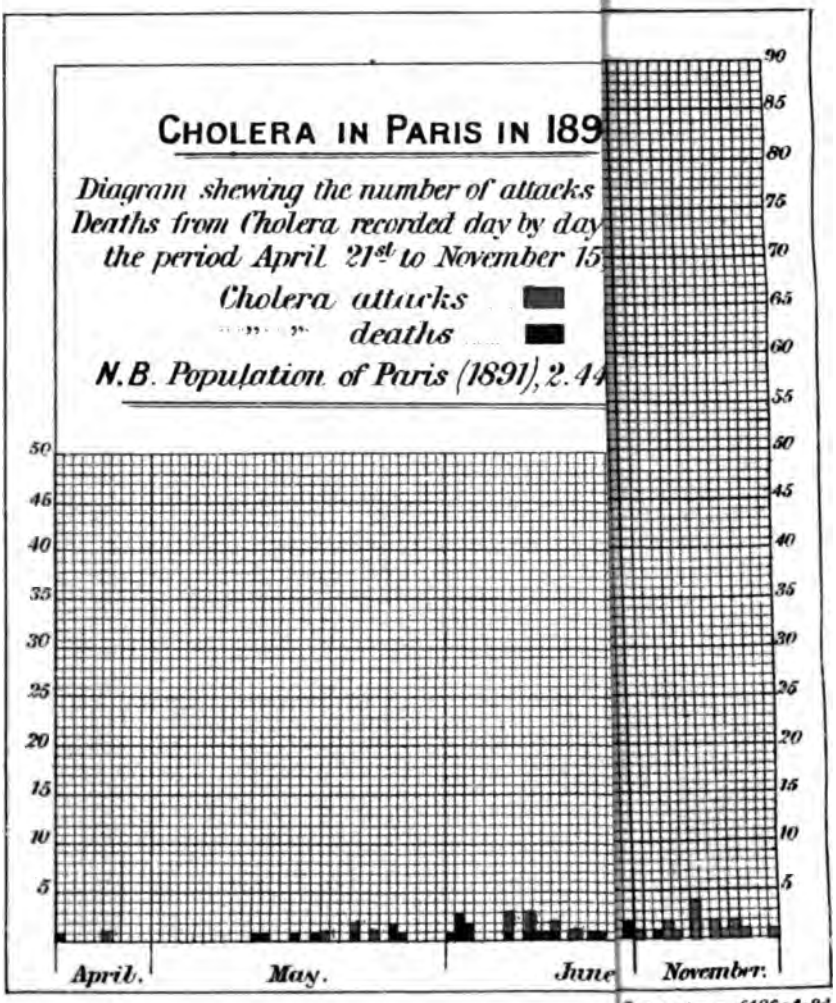

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of 15·6 per 10,000 of the population. Of this group of communes none escaped invasion.

In the group supplied with Seine water taken from the river below the outfall of the Parisian main sewer at Saint-Denis, which comprises a total population of 106,842 there were 389 deaths from cholera, equivalent to a rate of 36·4 per 10,000 of the population. All the communes obtaining their supply from this source were invaded.

In the group supplied with Marne water, which comprises a total population of 160,186 there were 83 deaths from cholera, equivalent to a rate of 5·1 per 10,000 of the population. Ten of the 22 communes contained in this group escaped invasion. Of the total deaths nearly half (39) occurred at Pantin, a commune situate next to that of Aubervilliers where cholera was exceedingly prevalent during 1892.*

There was thus in the Department of the Seine a direct correspondence between the character of the water supply and the mortality from cholera.

Notwithstanding the prevalence of cholera in the suburbs of Paris during April and May, only a few isolated cases were reported to have occurred in the city during those months. In June the cases became more numerous, but were said to have been chiefly confined to persons returning from infected districts in the suburbs. In July, however, a considerable increase took place and the disease became established in the City. It continued to spread in August, reaching its maximum at the end of that month, after which the daily number of cases gradually declined, until by the end of December cholera in Paris had practically ceased. The daily numbers of attacks and deaths from cholera in Paris are shown graphically in Diagram I. According to the report on the epidemic in the Department of the Seine, the total number of cases recorded to December 1st, 1892, was 2,249, of which 894, or 39·7 per cent., proved fatal. The deaths from cholera recorded in the several arrondissements and quarters of Paris during 1892 are given in Table XIX., and the relative mortality in the arrondissements is shown graphically in Map V.

Table XIX.

Deaths from Cholera in the several Arrondissements and Quarters of Paris from April 21st to December 1st, 1892.

Arrondissements.	Population 1891.	Deaths from Cholera. Number.	Deaths from Cholera. Rate per 10,000 Population.	Quarters.	Deaths from Cholera. Number.	Deaths from Cholera. Rate per 10,000 Population.
I.	66,399	16	2·4	1 Saint-Germain-l'Auxerrois	2	2·2
				2 Halles	7	1·0
				3 Palais-Royal	4	2·7
				4 Place-Vendôme	3	2·1
II.	69,812	12	1·7	5 Gaillon	—	—
				6 Vivienne	3	2·5
				7 Mail	—	—
				8 Bonne-Nouvelle	9	3·0

* It is stated that nearly all the deaths at Pantin took place at Quatres-Chemins, a part of Pantin which is only divided by a road from the centre at Aubervilliers, which suffered most from cholera.

Arrondisements.	Population 1891.	Deaths from Cholera. Number.	Deaths from Cholera. Rate per 10,000 Population.	Quarters.	Deaths from Cholera. Number.	Deaths from Cholera. Rate per 10,000 Population.
III.	90,000	18	2·0	9 Arts-et-Métiers	5	2·0
				10 Enfants-Rouges	7	3·3
				11 Archives	1	[0·3]
				12 Sainte-Avoie	5	2·3
IV.	100,046	32	3·2	13 Saint-Merri	9	3·6
				14 Saint-Gervais	9	2·2
				15 Arsenal	3	1·6
				16 Notre-Dame	11	8·0
V.	117,549	43	3·7	17 Saint-Victor	13	4·8
				18 Jardin-des-Plantes	11	4·1
				19 Val-de-Grâce	6	1·8
				20 Sorbonne	13	4·8
VI.	100,143	20	2·0	21 Mounaie	5	2·8
				22 Odéon	5	2·3
				23 Notre-Dame-des-Champs	7	1·6
				24 Saint-Germain-des-Prés	3	1·9
VII.	97,950	20	2·0	25 Saint-Thomas-d'Aquin	4	1·4
				26 Invalides	1	[0·7]
				27 École-Militaire	3	1·8
				28 Gros-Caillou	12	3·6
VIII.	107,485	12	1·1	29 Champs-Élysées	—	—
				30 Faubourg-du-Roule	4	1·6
				31 Madeleine	2	0·7
				32 Europe	6	1·5
IX.	121,289	15	1·2	33 Saint-Georges	6	1·6
				34 Chaussée-d'Antin	1	[0·4]
				35 Faubourg-Montmartre	—	—
				36 Rochechouart	8	2·2
X.	155,344	33	2·1	37 Saint-Vincent-de-Paul	8	1·9
				38 Porte-Saint-Denis	8	2·7
				39 Porte-Saint-Martin	6	1·7
				40 Hôpital-Saint-Louis	11	2·6
XI.	217,016	104	4·8	41 Folie Méricourt	13	2·4
				42 Saint-Ambroise	21	4·5
				43 Roquette	44	6·2
				44 Sainte-Marguerite	26	5·9
XII.	111,665	44	3·9	45 Bel-Air	2	1·9
				46 Picpus	17	3·7
				47 Bercy	1	[1·1]
				48 Quinze-Vingts	24	5·1
XIII.	110,956	45	4·1	49 Salpetrière	9	3·9
				50 Gare	18	4·7
				51 Maison-Blanche	15	4·5
				52 Croulebarbe	3	2·0

Arrondissements.	Population 1891.	Deaths from Cholera. Number.	Deaths from Cholera. Rate per 10,000 Population.	Quarters.	Deaths from Cholera. Number.	Deaths from Cholera. Rate per 10,000 Population.
XIV.	112,638	29	2·6	53 Montparnasse	6	2·2
				54 Santé	3	1·1
				55 Petit-Montrouge	8	3·3
				56 Plaisance	12	2·1
XV.	119,307	39	3·3	57 Saint-Lambert	5	1·9
				58 Necker	14	3·7
				59 Grenelle	11	3·1
				60 Javel	9	5·3
XVI.	89,226	23	2·6	61 Auteuil	10	5·2
				62 Muette	8	3·4
				63 Porte-Dauphine	4	2·3
				64 Bassins	1	[0·3]
XVII.	175,742	53	3·0	65 Les Ternes	13	3·4
				66 Plaine-Monceau	4	1·3
				67 Batignolles	17	3·1
				68 Epinettes	19	3·8
XVIII.	214,258	116	5·4	69 Grandes-Carrières	31	6·0
				70 Clignancourt	38	4·1
				71 Goutte-d'Or	24	5·5
				72 La Chapelle	23	9·8
XIX.	128,388	106	8·3	73 La Villette	53	10·4
				74 Pont-de-Flandre	15	10·7
				75 Amérique	10	4·6
				76 Combat	28	6·9
XX.	142,744	39	2·7	77 Belleville	14	2·8
				78 Saint-Fargeau	3	2·8
				79 Père-Lachaise	9	2·1
				80 Charonne	13	3·5
					819	
				Upon the Seine	5	
				Persons without fixed abode	32	
				„ from other districts	38	
				Total	894	

From the above Table it will be observed that all the arrondissements and 76 of the 80 quarters of Paris were invaded by cholera during 1892. The greatest mortality was recorded in Arrondissements XIX. and XVIII., where rates of 8·3 and 5·4 per 10,000 of the population were reached, and from Map V. it will be observed that these arrondissements are situate nearest those suburbs (St. Ouen and Aubervilliers) which suffered most from cholera in 1892.

From the following Table XX., in which are given the mortality statistics of cholera recorded in the city of Paris during the several epidemics since 1832, it will be seen that the total number of deaths recorded in 1892 was less than in any previous epidemic with the exception of 1873, whilst the death-rate per 10,000 of the population (3·6) was lower in 1892 than in any previous epidemic.

Table XX.

Mortality Statistics of Cholera recorded in the City of Paris in each of seven Epidemics.

Year.	Population.	Total deaths recorded from Cholera.	Cholera death-rate per 10,000 Population.
1832	785,862	18,402	234·5
1849	1,053,262	19,184	182·5
1853–54	1,174,346	7,626	64·9
1865–66	1,825,274	11,008	60·2
1873	1,851,792	854	4·6
1884	2,260,945	952	4·2
1892	2,447,957	894	3·6

From the cholera centre formed in the Department of the Seine, the disease spread to other parts of France, invading in the first instance the Departments of Seine-Inférieure (April 7th) and Seine-et-Oise (April 16th), both situate on the Seine below Paris. In Table XXI., which has been compiled from data courteously supplied by M. Monod, will be found the date of the first recorded death from cholera in each of the Departments of France invaded during 1892, together with the number of deaths recorded during the year as due to that disease, and the number of communes in each department in which fatal cholera was recorded. In this Table the population of the several departments, as ascertained at the census of 1891, is also given, together with the death-rate from cholera per 10,000 of the population. In Table A. appended to this Report, also compiled from data furnished by M. Monod, will be found detailed information as to the population, date of first of last recorded deaths from cholera, number of deaths, and the cholera death-rate per 10,000 of the population of each commune invaded during 1892.

Table XXI.

Showing the Number of Deaths from Cholera recorded in the several Departments of France invaded in 1892 with the Death-rate from Cholera per 10,000 of the Population.

Department.	Population, 1891.	Date of first recorded Death from Cholera.	Total Deaths recorded due to Cholera 1892.	Death-rate from Cholera per 10,000 Population, 1892.	Number of Communes in which fatal Cholera was recorded in 1892.
Seine	3,141,595	March 31	1,858	*5·9*	45
Seine Inférieure	839,876	April 7	983	*11·7*	79
Seine-et-Oise	628,590	„ 16	270	*4·3*	30
Oise	401,835	May 6	61	*1·5*	26
Marne	434,692	June 12	7	*0·2*	3
Gard	419,388	„ 27	5	*0·1*	1
Basses-Pyrénées	425,027	July 10	10	*0·2*	1
Bouches-du-Rhône	630,622	„ 12	90	*1·4*	2
Seine-et-Marne	356,709	„ 13	23	*0·6*	11

MAP VII.

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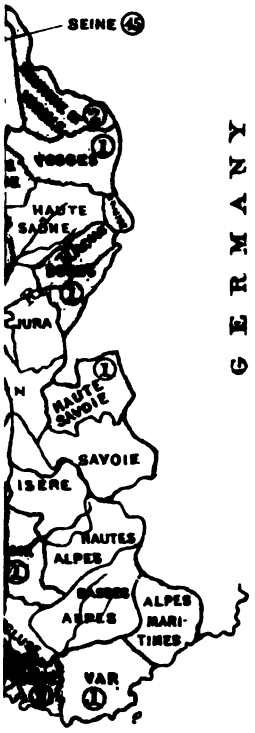

nents invaded during

eks ended May 1st
May 29th
June 26th
July 24th
Aug. 21st
Sept. 18th
18th to end of year

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Department.	Population, 1891.	Date of first recorded Death from Cholera.	Total Deaths recorded due to Cholera 1892.	Death-rate from Cholera per 10,000 Population, 1892.	Number of Communes in which fatal Cholera was recorded in 1892.
Finistère	727,012	„ 14	12	0·2	8
Eure-et-Loir	284,683	„ 18	38	1·3	4
Somme	546,495	„ 18	39	0·7	14
Dordogne	478,471	„ 19	2	0·04	1
Côte-d'Or	376,866	„ 21	1	[0·03]	1
Meurthe-et-Moselle	444,150	„ 26	10	0·2	2
Yonne	344,688	„ 27	1	[0·03]	1
Nord	1,736,341	„ 28	152	0·9	35
Indre-et-Loire	337,298	Aug. 1	2	0·06	1
Vosgnes	410,196	„ 1	2	0 05	1
Haute Marne	243,533	„ 3	2	0·08	1
Aude	317,372	„ 8	1	[0·03]	1
Eure	349,471	„ 16	101	2·9	20
Sarthe	429,737	„ 20	5	0·1	1
Charente-Inférieure	456,202	„ 21	5	0·1	5
Côtes-du-Nord	618,652	„ 25	2	0·03	2
Calvados	428,945	„ 28	56	1·3	5
Corrèze	328,119	„ 30	1	[0·03]	1
Orne	354,387	„ 30	1	[0·03]	1
Hérault	461,651	„ 31	1	[0·02]	1
Morbihan	544,470	Sept. 1	223	4·1	15
Aisne	545,493	„ 2	10	0·2	5
Aveyron	400,467	„ 2	3	0·07	3
Manche	513,815	„ 6	139	2·7	8
Meuse	292,253	„ 7	9	0·3	1
Mayenne	332,387	„ 8	1	[0·03]	1
Haute Savoie	268,267	„ 10	4	0·15	1
Loire Inférieure	645,263	„ 11	72	1·1	5
Vendée	442,355	„ 14	10	0·2	1
Cher	359,276	„ 17	3	0·08	3
Pas-de-Calais	874,364	„ 17	320	3·7	57
Loriet	377,718	„ 22	1	[0·03]	1
Puy-de-Dôme	564,266	Oct. 1	2	0·04	1
Ardennes	324,923	„ 1	1	[0·03]	1
Drôme	306,419	„ 5	1	[0·03]	1
Doubs	303,081	„ 7	3	0·1	1
Gironde	793,528	„ 16	1	[0·01]	1
Var	288,336	„ 27	4	0·1	1
Charente	360,259	Nov. 28	1	[0·03]	1
Maine-et-Loire	518,589	Dec. 14	1	[0·02]	1
TOTALS	26,002,132	—	4,550	1·75	391

From a study of these Tables and of Map VII., in which the march of cholera month by month in France is shown graphically, it will be observed that during the first three months after the first recorded appearance of cholera, fatal cholera was noted in five departments only, all situate near each other, namely, the Departments of Seine, Seine Inférieure, Seine-et-Oise, Marne. and Oise. In each of these the first cases were said to have been traced to direct communication with the Parisian suburbs. During the fourth month the disease became more widely diffused, fatal cholera being recorded in nine new departments. Of these, three, Somme, Seine-et-Marne, and Eure-et-Loir, were situate close to the group of departments already invaded; one, Finistère,

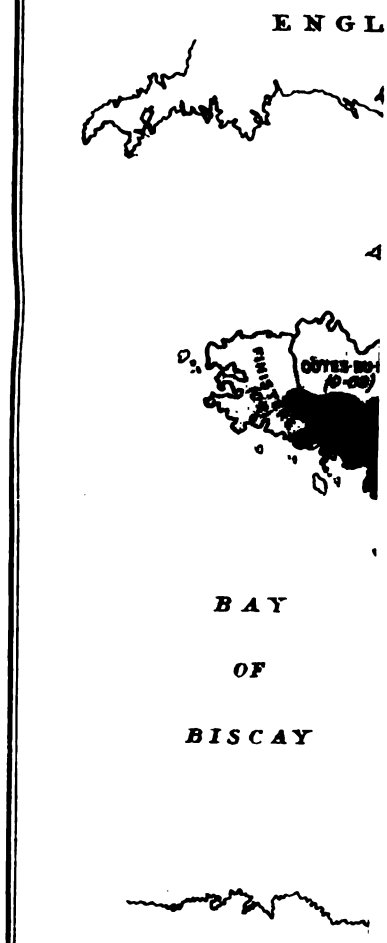
situate at the western extremity of the country; three, Basses-Pyrénées, Gard, and Bouches-du-Rhône (Marseille), situate in the south of France, and the remaining two, Dordogne and Côte-d'Or, in each of which a single commune only was invaded, situate in the interior of France. In the fifth month, 10 more departments were reported to have suffered from fatal cholera. These were chiefly situate in the neighbourhood of departments already invaded, but no great diffusion of the disease was observed in any of the ten, with the exception of the departments of Nord and of Eure. The greatest extension took place in the four weeks ended September 18th, when fatal cholera was recorded in 16 new departments, of which the more important were situate to the north and north-west of the country, and amongst others comprised Pas-de-Calais, Calvados, Manche, and Morbihan, in each of which numerous communes were invaded. From September 18th to the end of the year, nine further departments were invaded, but in none of these did the disease extend beyond a single commune. During the period from the first commencement of cholera in France to December 31st, 1892, fatal cholera was recorded in 391 communes situate in 49 departments. The total number of deaths from cholera recorded during 1892 was 4,550, a number equivalent to a death-rate of 1·75 per 10,000 of the population of the departments invaded by the disease. In 6 only of the 49 departments in which fatal cholera was recorded did the cholera death-rate exceed the mean, 1·75 of the invaded departments, namely, Seine-Inférieure, 11·7, Seine, 5·9, Seine-et-Oise, 4·3, Pas-de-Calais, 3·7, Morbihan, 4·1, Eure, 2·9, and Manche, 2·7, whilst in no less than 26 departments only a single commune was invaded in each. Upon reference to Map VIII., in which the relative mortality from cholera in the several departments of France is shown graphically, it will be observed that all the departments in which a cholera death-rate of upwards of 1 per 10·000 of the population was recorded in 1892 were, with the single exception of Bouches-du-Rhône, situate in the north or north-west of France.

The chief centres of cholera in France in 1892 are given in Table XXII.

Table XXII.

Showing the Chief Centres of Cholera in France in 1892.

Department.	Commune.	Population. Census 1891.	Date of First Recorded Death from Cholera, 1892.	Total Deaths recorded from Cholera, 1892.	Death-rate Cholera per 10,000 Population.	Date of last Recorded Death from Cholera, 1892.
Seine	Nanterre	10,430	Mar. 31	67	64·2	Sept. 16.
	Neuilly	29,444	April 13	32	10·8	Oct. 5.
	Puteaux	17,646	„ 13	53	30·0	Nov. 5.
	Ile-Saint-Denis	2,268	„ 13	9	39·7	Sept. 29.
	Courbevoie	17,597	„ 15	38	21·6	Oct. 1.
	Saint-Denis	50,992	„ 17	104	20·4	Dec. 4.
	Colombes	18,918	„ 18	21	11·1	Oct. 31.
	Levallois-Perret	39,857	„ 21	68	17·1	„ 7.
	Suresnes	8,404	„ 24	20	23·8	„ 11.
	Saint-Ouen	25,969	„ 30	142	54·6	„ 22.
	Clichy	30,698	May 4	46	14·2	Nov. 24.
	Paris	2,424,705	„ 16	907	4·2	Dec. 26.
	Asnières	19,575	„ 24	25	12·7	Nov. 2.
	Boulogne-sur-Seine	32,569	June 2	31	9·5	Oct. 17.
	Montreuil-sous-Bois	23,986	„ 6	19	7·9	Dec. 13.
	Aubervilliers	25,022	„ 11	134	53·9	Oct. 13.
	Pantin	21,847	„ 23	39	17·8	Dec. 17.
	Gennevilliers	5,837	„ 27	13	22·2	Sept. 28.



Map shewing the Di
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Department.	Commune.	Population. Census 1891.	Date of first Recorded Death from Cholera, 1892.	Total Deaths recorded from Cholera, 1892.	Cholera Death-rate per 10,000 Population.	Date of last Recorded Death from Cholera, 1892.
Seine-Inférieure	Saint-Aignan	3,379	April 7	15	44·4	Dec. 9.
	Havre	116,369	July 15	498	42·7	Oct. 25.
	Rouen	112,352	Aug. 12	72	6·4	Dec. 22.
	Sanvic	6,880	„ 13	15	21·8	Oct. 15.
	Graville-Ste-Honorine	7,500	„ 15	64	85·3	„ 13.
	Dieppe	22,771	„ 17	79	34·7	„ 29.
	Sotteville-lès-Rouen	16,386	„ 18	11	6·7	Sept. 18.
	Bléville	2,843	„ 23	10	35·1	„ 27.
	Gueures	737	„ 23	15	203·5	Oct. 5.
	Monville	2,520	„ 28	11	43·6	Nov. 30.
	Elbeuf	21,404	Sept. 5	10	4·7	Oct. 10.
	Montivilliers	5,344	„ 14	10	18·7	„ 24.
	Tréport	4,569	„ 15	21	46·0	„ 18.
Seine-et-Oise	Argenteuil	13,339	April 16	122	91·5	Sept. 11.
	Beaumont-sur-Oise	3,099	June 24	18	58·0	„ 3.
	Bezons	2,406	„ 28	8	33·2	July 19.
	Gonesse	2,642	July 12	22	83·2	Sept. 6.
	Sarcelles	2,118	„ 21	45	202·0	„ 2.
Oise	Montataire	5,296	Oct. 3	9	17·0	Nov. 10.
Basses-Pyrénées	Briscous	1,517	July 10	10	65·9	Sept. 9.
Bouches-du-Rhône	Marseille	403,749	„ 12	89	2·2	Nov. 13.
Eure-et-Loir	Bonneval	8,787	„ 18	35	98·3	Sept. 9.
Somme	Abbeville	19,851	Oct. 21	19	9·6	Dec. 24.
Meurthe-et-Moselle	Hondreville	597	„ 4	8	134·0	Oct. 19.
Nord	Denain	18,258	Aug. 19	10	5·5	Aug. 29.
	Dunkerque	39,498	Sept. 1	35	8·9	Dec. 29.
	Trith-Saint-Léger	3,537	„ 1	12	33·9	Nov. 22.
	Maing	2,391	„ 4	14	58·6	Oct. 9.
	Grand-Fort-Philippe	2,842	Nov. 23	24	84·4	Dec. 29.
Eure	Port Audemer	6,084	Aug. 26	25	41·1	Sept. 23.
	Brionne	3,577	„ 29	35	97·8	Oct. 20.
Calvados	Deauville	2,532	Sept. 3	14	55·3	„ 27.
	Trouville	6,243	„ 7	14	22·4	„ 16.
	Liseaux	16,260	„ 19	19	11·7	Nov. 15.
Morbihan	Caudan	7,670	„ 4	22	28·7	Dec. 24.
	Plœmeur	12,413	Oct. 12	14	11·3	„ 25.
	Lorient	42,116	„ 25	101	24·0	„ 31.
	Hennebont	6,972	Nov. 12	14	20·1	„ 29.
	Port-Louis	3,431	„ 27	12	35·0	„ 22.
	Gavres	1,227	Dec. 2	7	57·1	„ 29.
Manche	Tourlaville	7,382	Sept. 17	30	40·1	„ 11.
	Cherbourg	38,554	„ 17	87	22·6	„ 29.
	Equeurdreville	5,421	Nov. 4	12	22·1	Nov. 29.
Meuse	Jametz	565	Sept. 7	9	159·2	Oct. 21.
Loire-Inférieure	Nantes	122,730	„ 11	61	5·0	Dec. 28.
Vendée	Sables-d'Olonnes	11,557	„ 14	10	8·7	Oct. 9.
Pas-de-Calais	Le Portel	5,329	„ 17	59	110·8	Dec. 29.
	Saint-Omer	21,661	„ 17	9	4·2	„ 23.
	Boulogne-sur-Mer	45,305	„ 25	33	7·3	„ 2.
	Calais	56,867	„ 28	25	4·4	„ 21.
	Outréau	3,862	Oct. 5	10	25·9	„ 16.
	Étaples	3,816	„ 21	43	112·8	„ 23.
	Montreuil	3,603	Nov. 5	15	41·7	„ 28.
	Preures	745	„ 27	11	147·6	„ 26.
	Halinghem	458	Dec. 3	9	196·5	„ 25.

From Table XXII. it will be seen that next to Paris the greatest number of deaths recorded from cholera in 1892 took place at Havre,

where between July 26th and October 25th 498 deaths occurred, a number equivalent to a death-rate of 42·7 per 10,000 of the population. Here the disease was first observed in July, when it was reported to have been introduced from Courbevoie, in the Department of the Seine, but it was not until the third week of August that it showed any signs of becoming epidemic. During the week ending August 18th 110 cases and 41 deaths were recorded. In the following week ending August 25th 338 cases and 101 deaths took place, whilst in that ending September 1st the maximum of both attacks and deaths was reached, when 419 attacks and 143 deaths were recorded. After that date the disease gradually declined, the town being declared free from cholera during the last week of October. In the following Table XXIII. the daily record of cholera attacks and deaths at Havre is given, the figures being taken from Dr. Gibert's official report.* It will be observed that the number of deaths given in this table are considerably in excess of the number given in Table XXII., which were derived from the records of the Central Department. It is possible that this is due to the inclusion in Table XXIII. of cases from outside districts treated in hospitals at Havre.

TABLE XXIII.

DAILY RECORD of CHOLERA CASES and DEATHS during 1892 at HAVRE.

Day of Month.	Number of Cholera		Week ending	Number of Cholera	
	Cases.	Deaths.		Cases.	Deaths.
July 15	1	1			
„ 16	—	—			
„ 17	—	—			
„ 18	—	—	July 21	1	1
„ 19	—	—			
„ 20	—	—			
„ 21	—	—			
„ 22		—			
„ 23	—	—			
„ 24	—	—			
„ 25	—	—	„ 28	1	1
„ 26	—	—			
„ 27	—	—			
„ 28	1	1			
„ 29	—	—			
„ 30	1	—			
„ 31	—	—			
Aug. 1	—	—	Aug. 4	6	3
„ 2	3	1			
„ 3	—	—			
„ 4	2	2			
„ 5	—	—			
„ 6	—	—			
„ 7	—	—			
„ 8	—	—	„ 11	2	1
„ 9	2	1			
„ 10	—	—			
„ 11	—	—			
„ 12	3	3			
„ 13	8	7			
„ 14	1	1			

* *See* footnote ||, page 117, *ante*.

Day of Month.	Number of Cholera		Week ending	Number of Cholera	
	Cases.	Deaths.		Cases.	Deaths.
Aug. 15 -	1	1	} Aug. 18 -	110	41
„ 16 -	28	6			
„ 17 -	23	12			
„ 18 -	46	11			
„ 19 -	34	8			
„ 20 -	52	9			
„ 21 -	45	7			
„ 22 -	61	18	} „ 25 -	338	101
„ 23 -	47	20			
„ 24 -	51	20			
„ 25 -	48	19			
„ 26 -	45	15			
„ 27 -	71	23			
„ 28 -	60	22			
„ 29 -	70	23	} Sept. 1 -	419	143
„ 30 -	65	26			
„ 31 -	59	13			
Sept. 1 -	49	21			
„ 2 -	43	12			
„ 3 -	36	13			
„ 4 -	27	13			
„ 5 -	34	14	} „ 8 -	197	83
„ 6 -	27	9			
„ 7 -	19	10			
„ 8 -	11	12			
„ 9 -	15	8			
„ 10 -	8	9			
„ 11 -	13	7			
„ 12 -	13	8	} „ 15 -	88	46
„ 13 -	11	6			
„ 14 -	13	2			
„ 15 -	15	6			
„ 16 -	7	5			
„ 17 -	7	8			
„ 18 -	9	—			
„ 19 -	7	6	} „ 22 -	49	36
„ 20 -	4	2			
„ 21 -	7	7			
„ 22 -	8	8			
„ 23 -	10	2			
„ 24 -	7	7			
„ 25 -	4	5			
„ 26 -	9	3	} „ 29 -	43	28
„ 27 -	4	2			
„ 28 -	6	6			
„ 29 -	3	3			
„ 30 -	4	2			
Oct. 1	2	2			
„ 2 -	4	4			
„ 3 -	3	5	} Oct. 6 -	19	18
„ 4 -	1	3			
„ 5 -	4	—			
„ 6 -	1	2			
„ 7 -	1	2			
„ 8 -	3	2			
„ 9 -	4	3			
„ 10 -	4	1	} „ 13 -	23	16
„ 11 -	3	3			
„ 12 -	6	2			
„ 13	2	3			

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Day of Month.	Number of Cholera		Week ending	Number of Cholera	
	Cases.	Deaths.		Cases.	Deaths.
Oct. 14 -	2	3			
„ 15 -	—	2			
„ 16 -	—	—			
„ 17 -	3	2	Oct. 20 -	5	11
„ 18 -	—	—			
„ 19 -	—	2			
„ 20 -	—	2			
„ 21 -	1	—			
„ 22 -	1	1			
„ 23 -	1.	—			
„ 24 -	—	1	„ 27 -	4	3
„ 25 -	1	1			
„ 26 -	—	—			
„ 27 -	—	—			
				1,305	532
			Cases, fatal, first notification received after death -	30	—
				1,335	532

Although I have been enabled through the courtesy of M. Monod to give complete statistics as regards cholera mortality in France during 1892, I do not, in the absence of the official report, which has not as yet been published, propose to comment further on the diffusion of cholera in France. It is, however, noteworthy to observe that notwithstanding the fact that numerous seaports on the northern coast of France, such as Havre, Calais, Boulogne-sur-Mer, Dieppe, and Dunkerque, where cholera was extensively prevalent, were in constant communication with ports situate on the south coast of England, so far as is known not a single case of the disease was transmitted to this country.

Belgium.

On July 21st, a case of cholera was notified at Aspelaere in the Province of Flandre Orientale. This case was that of a workman who was attacked by colic and diarrhœa on his return from Argenteuil, a commune in the Department of Seine-et-Oise, in which cholera had prevailed since April 16th. On July 29th, another workman who had been engaged with the harvesters at Aubervilliers in the Department of the Seine, where there had been cases of cholera since June 11th, died on his return to Etichove a commune also situate in the Province of Flandre Orientale, after having presented every appearance of cholera. This case, like the preceding one, remained isolated. On August 13th, a brickmaker who was working at Sarcelles in the Department of Seine-et-Oise, (which had been invaded by cholera on July 21st), was attacked by serious cholerine and was brought by his father to Jumet in the Province of Hainaut. This man recovered, but the father, who had returned to France, came back to Jumet on August 18th with all the symptoms of cholera, and died the following day.

Subsequently eight other cases occurred at Jumet of which six proved fatal.

On August 15th, the steamer "St. Paul" arrived at Anvers (Antwerp) from Havre, after a passage of 30 hours. This vessel had a crew of 18 men and there was no doctor on board. She had left Marseilles on July 22nd, Cette on the 26th, and St. Nazaire on August 2nd. She had sailed from Havre on August 12th with four passengers, and was furnished at Havre with a clean bill of health which had been viséd by the Belgian Consul. Nothing abnormal was observed when this vessel passed the sanitary station at Doel, but hardly had she been moored at Anvers when a sailor presenting all the appearances of cholera was landed, and was taken to the Stuyvenberg hospital, where he died almost immediately afterwards. Two days later, on August 17th, two other sailors from the "St. Paul" were admitted to the hospital, suffering from cholera. One of these men died on August 19th, and one on August 20th. On August 18th, the steward of the "St. Marc," which was moored near the "St. Paul," presented symptoms of cholera; on August 20th, a fourth sailor from the "St. Paul" was sent to the hospital, where he died on the 22nd; on the 20th also a boat-woman who had washed the sailor's clothes died from cholera on board her own boat, and her husband was attacked on August 25th.

On August 23rd, two dock labourers who had been working on the "St. Paul," were attacked by the disease, and died during the night. On the 23rd also a child, aged 11, who had been found in the Avenue de Commerce suffering from true cholera was admitted to the hospital. The next day three women living near the docks, who had been in contact with the dock labourers referred to above, were taken to the hospital, where one of them died on the same day. Thus, up to but not including the 25th, 12 cases of cholera had occurred at Anvers, and of these nine had proved fatal; all these cases being clearly due to the importation of the disease from Havre. In the mean time, on August 23rd, a sailor suffering from cholera was removed to the hospital from the "Nerissa," on her arrival from Hamburg.

Once introduced into Anvers, cholera spread slowly in that city, and was thence transmitted directly to the following localities:—

August 25th to Steendorp in the province of Flandre Orientale.
August 26th to Boom and Niel in the province of Anvers.
August 28th to Haesdonck in the province of Flandre Orientale.
August 29th to Malines in the province of Anvers.
August 29th to Châtelet in the province of Hainaut.
August 30th to Gand in the province of Flandre Occidentale.
August 31st to Bruges in the province of Flandre Occidentale.
August 31st to Rupelmonde in the province of Flandre Orientale.
September 2nd to Willebroeck, Eeckeren, and Boom (second time) all in the province of Anvers.
September 3rd to Hoboken in the province of Anvers.
September 4th to Hemixem in the province of Anvers.
September 4th to Etterbeck in the province of Brabant.
September 5th to Merxem in the province of Anvers.
September 8th to Tamise and Moerbeke (Waes) both in the province of Flandre Orientale.
September 9th to Steendorp (second time) in the province of Flandre Orientale.
September 13th to Oeleghem in the province of Anvers.
September 14th to Ranst in the province of Anvers.
September 19th to Ath in the province of Hainaut.

From Boom the disease spread to Bornhem on August 31st, to Terhaegen on September 5th, both communes in the province of Anvers, and to Quaedmechelen in the province of Limbourg on September 23rd.

The following communes became infected through the medium of boatmen: Boom, Niel, Châtelet, Bruges, Rupelmonde, Steendorp, Willebroeck, Hemixem, Tamise, Moerbeke, Oeleghem, Ath, Terhaegen, and Quaedmechelen. In several districts, such as Eeckeren, Ranst, and Hoboken, the introduction of the disease was traced to labourers working in the docks at Anvers.

It would serve no useful purpose to trace the route of the disease in greater detail. Belgium is covered by a network of railways, and these are supplemented by numerous rivers and canals, which afford ample means of communication between different places. Up to October 12th, 124 communes had been invaded, apportioned according to provinces as follows: 34 in Anvers, 18 in Brabant, 10 in Flandre Occidentale, 25 in Flandre Orientale, 26 in Hainaut, 4 in Liége, 4 in Limbourg, 1 in Luxembourg, and 2 in Namur.

The march of cholera in Belgium month by month and the topographical position of the invaded communes are shown graphically in Map IX.

The total number of cases of cholera recorded in Belgium from the date of the introduction of the disease on July 20th to October 12th was 1,207 in number, and of these 626 had, up to that date, proved fatal. Taking the population of Belgium at 6,000,000, the above figures are equivalent to cholera attack and death rates of 2·0 and 1·04 respectively per 10,000 of the population.

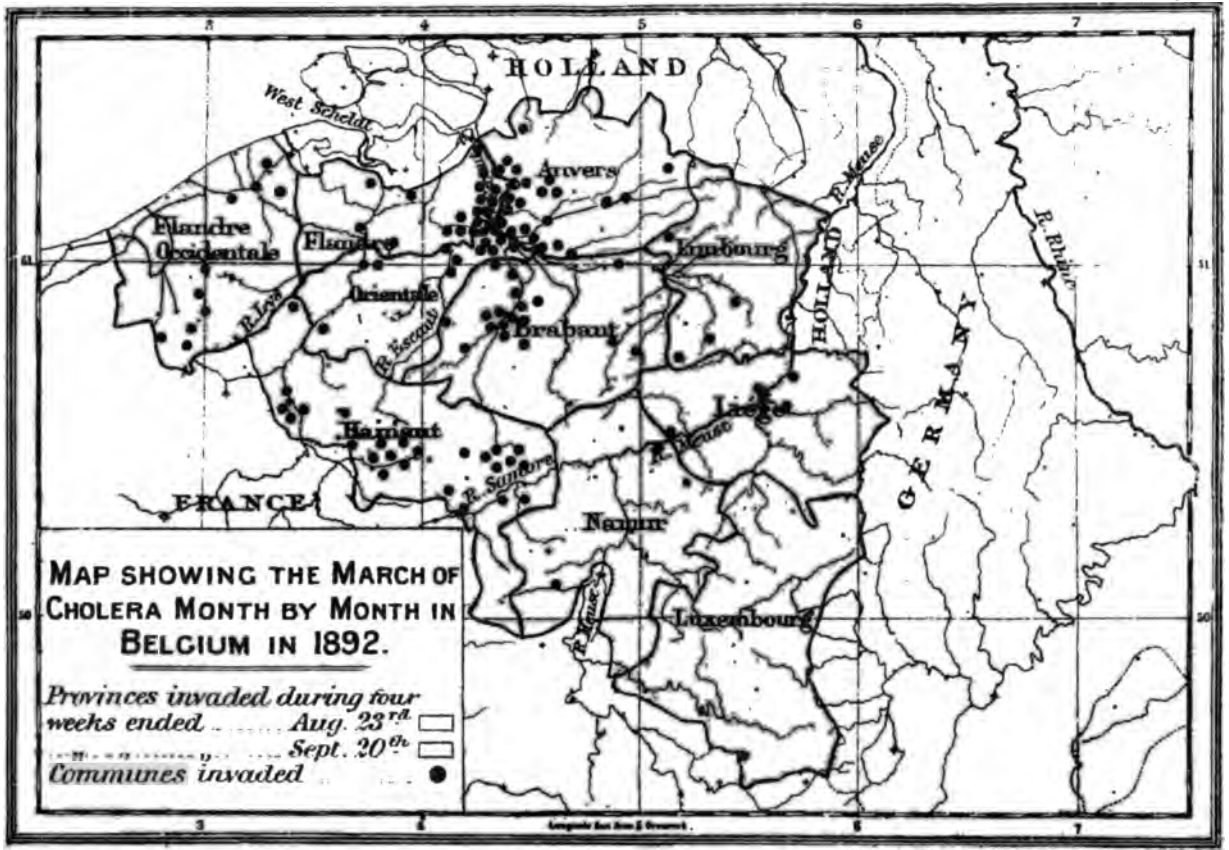
The chief centres of the disease are given in the following Table:—

TABLE XXIV.

Name of Place.	Date of First Case of Cholera.	Population.	Total recorded Cholera.		Rates per 10,000 of the Inhabitants.		Percentage of Deaths to Attacks. "Fatality."
			Attacks.	Deaths.	Attacks.	Deaths.	
		PROVINCE OF ANVERS.					
Anvers (Antwerp)	Aug. 15	224,012	251	92	11·2	4·1	36·7
Boom	„ 26	13,892	101	49	72·7	35·2	48·5
Niel	„ 26	6,020	76	39	126·0	65·0	51·3
Malines (Mchlin)	„ 29	51,014	35	16	6·1	2·8	45·8
Bornhem	„ 31	5,463	29	18	53·0	33·0	62·1
Willebroeck	Sept. 2	8,164	64	40	78·5	49·0	62·5
Eeckeren	„ 2	4,806	15	9	31·0	19·0	60·0
Merxem	„ 5	8,453	13	7	15·4	8·3	53·9
Terhaegen	„ 5	2,400	11	7	46·0	29·0	63·6
Borgerhout	„ 15	28,882	11	7	3·8	2·4	63·6
Rumpst	„ 27	4,066	50	13	123·0	32·0	26·0
		PROVINCE OF BRABANT.					
Molenbeek	Sept. 1	48,723	50	43	10·3	8·8	86·0
Anderlecht	„ 18	33,311	20	13	6·0	4·0	65·0

CHOLERA IN BELGIUM 1892.

Map IX.



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Name of Place.	Date of First Case of Cholera.	Population.	Total recorded Cholera.		Rates per 10,000 of the Inhabitants.		Percentage of Deaths to Attacks. "Fatality."
			Attacks.	Deaths.	Attacks.	Deaths.	
Province of Flandre Orientale.							
Alost - -	Aug. 23	25,544	15	4	5·9	1·6	26·7
Steendorp - -	„ 25	2,932	88	51	301·0	174·0	57·9
Burght - -	„ 26	2,570	33	16	128·0	62·0	48·5
Gand (Ghent) -	„ 27	148,729	7	5	0·5	0·3	—
Zwyndrecht - -	„ 30	4,619	6	4	13·0	8·6	—
Baesrode - -	Sept. 1	4,138	21	12	51·0	29·0	57·2
Moerbeke-Waes -	„ 8	5,343	11	8	20·6	15·0	72·6
Tamise - -	„ 8	1,039	9	5	8·2	4·5	55·6
Province of Hainaut.							
Jumet - -	Aug. 13	23,927	10	7	4·2	2·9	70·0
Paturages - -	Sept. 20	10,739	40	21	37·0	20·0	52·5
Flénu - -	„ 20	4,410	10	7	23·0	16·0	70·0
Wasmes - -	„ 21	13,105	27	7	20·6	5·3	25·9
Quaregnon - -	„ 22	14,361	10	7	7·0	4·9	70·0

Of all places in Belgium, Steendorp, in proportion to its population, suffered the most severely. Steendorp, which has a population of 2,932, is a small town situate near Rupelmonde on the bank of the River Escaut, and is in intimate connexion with Anvers, Boom, and other waterside districts. The importation of cholera was effected several times by boatmen from Anvers. In this town, from August 25th, the date of the first case of cholera, to October 12th, 88 cases, of which 51 were fatal, occurred, these numbers being equivalent to cholera attack and death-rates of 301 and 174 per 10,000 of the population respectively. The reason given for the exceptional prevalence of the disease at Steendorp was its insanitary condition, the population consisting for the most part of workmen, living amongst unhealthy surroundings. In Anvers and other towns it was observed that cholera frequently invaded the same localities and even the same houses as had been attacked in the epidemics of 1849, 1853, 1854, 1866, and 1867. In one town, Cheratte, in the province of Liége, the only suspected case of cholera in that commune, was reported to have occurred in the same house in which cholera commenced in 1866.

In the following Table XXV. are given the attacks and deaths from cholera which were recorded in the several provinces of Belgium from the commencement of the epidemic to October 12th, 1892.

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the Origin Progress of Western fusion of lera in 1892; Dr. Barry.

Table XXV.

Provinces.	Date of First Case of Cholera.	Population.	Total recorded Cholera.		Rates per 10,000 of the Population.		Per-centage of Deaths to Attack. "Fatality."
			Attacks.	Deaths.	Attacks.	Deaths.	
Flandre Orientale -	July 20	949,526	220	123	2·3	1·3	56·0
Flandre Occidentale	„ 26	738,442	17	13	0·2	0·2	76·5
Hainaut - -	Aug. 13	1,048,546	132	68	1·3	0·65	51·6
Anvers (Antwerp) -	„ 15	639,919	715	338	10·2	4·8	47·3
Liége - -	„ 24	756,734	5	3	0·1	0·04	60·0
Brabant - -	„ 25	1,106,158	105	75	1·0	0·7	71·5
Limbourg - -	Sept. 2	222,814	4	3	0·2	0·1	75·0
Namur - -	„ 8	335,171	2	—	0·1	0·0	—
Luxembourg -	„ 11	211,711	7	3	0·3	0·1	42·9
Belgium - -	—	**6,069,321**	**1,207**	**626**	**2·0**	**1·04**	**51·8**

For the above account of cholera in Belgium in 1892, I am mainly indebted to M. Beco's report on the epidemic referred to on p. 117 (footnote ‡‡), in which it is dealt with from its commencement, to October 12th, 1892. No official report with respect to the remainder of the year has up to the date of this report going to the press been received, but by the courtesy of M. Beco I am enabled to give in Table XXVI. the cholera statistics for Belgium for the whole year 1892 and in Map X. the relative mortality from cholera in the several provinces of Belgium during 1892 is shown graphically.

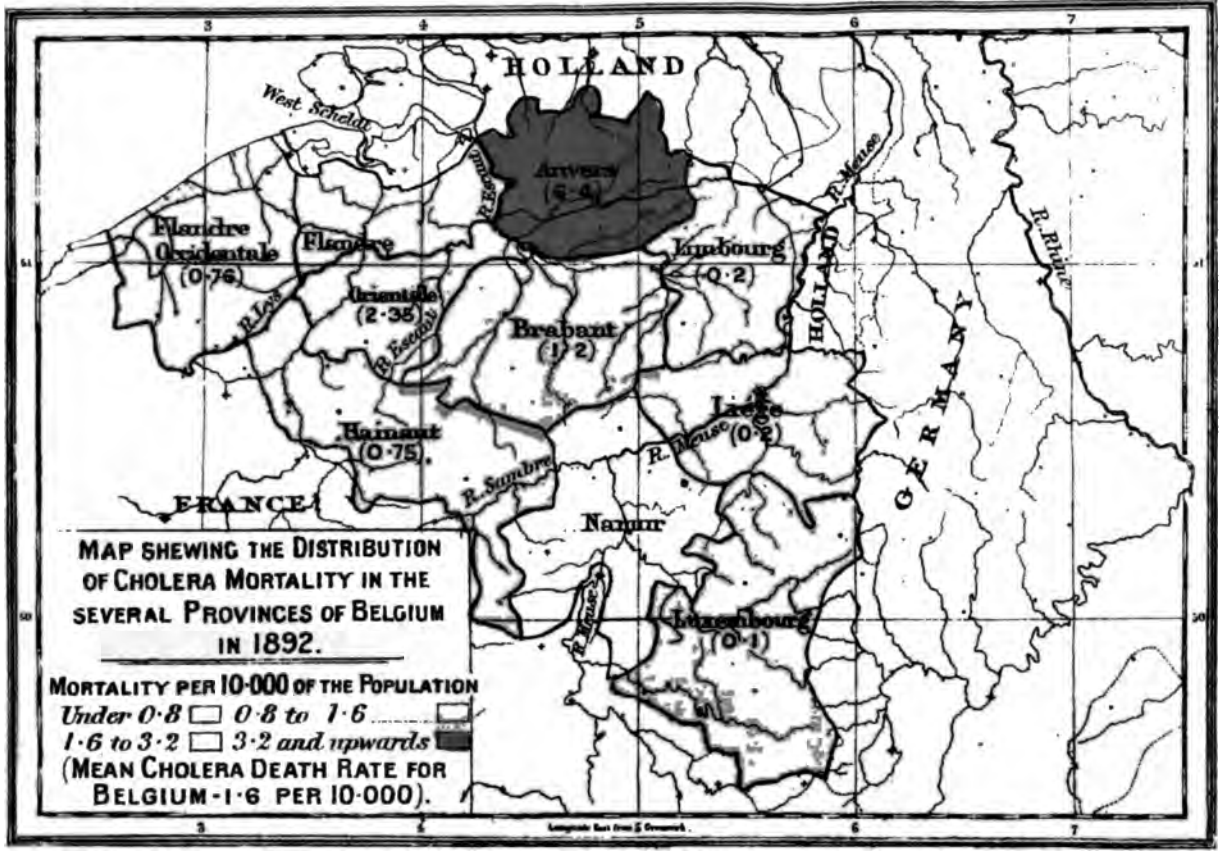
Table XXVI.

Cholera Statistics recorded in Belgium in 1892.

Provinces.	Total Number of Communes invaded by Cholera, 1892.	Total recorded Cholera		Rates per 10,000 of the Population Cholera.		Per-centage of Deaths to Attack. "Fatality."
		Attacks.	Deaths.	Attacks.	Deaths.	
Flandre Orientale - -	20	432	223	4·55	2·35	51·6
Flandre Occidentale - -	16	105	56	1·4	0·8	53·4
Hainaut . - - -	26	208	79	2·0	0·7	38·0
Anvers - - - -	34	871	446	12·5	6·4	51·2
Liége - - - -	6	33	16	0·4	0·2	48·5
Brabant - - - -	18	186	133	1·7	1·2	71·5
Limbourg - - -	6	8	5	0·35	0·2	62·5
Namur - - - -	2	2	—	0·6	0·0	—
Luxembourg - - -	1	7	3	0·3	0·1	42·9
Belgium - - -	**138**	**1,852**	**961**	**3·0**	**1·6**	**51·8**

CHOLERA IN BELGIUM 1892.

Map X.



In consequence of news received early in July of the prevalence of cholera in South Russia and in Persia, the Imperial Government, on July 6th, warned the Federal States of the danger of an importation of cholera by means of ships coming from the Black Sea and from the Persian Gulf, and urged upon the Seaboard States the necessity for the stringent enforcement of the regulations with regard to the sanitary supervision of ships, which had been agreed upon between the Federal States in 1883. In view also of the reported outbreak of cholera in France, these regulations were applied to all vessels coming from harbours situate on the northern coast of France between Cherbourg and the Belgian frontier, and from Marseilles.

The further spread of cholera in Russia led the Government of Prussia—the State most threatened—to issue orders on July 25th, prohibiting the entry from Russia, and the passage through the kingdom of used body and bed linen, worn clothes (exclusive of the clothing and linen of travellers), of rags of all sorts, of fruit, fresh vegetables, butter, and the so-called soft cheeses. At the same time instructions were given for the disinfection, at the frontier, of all soiled linen and clothing of travellers, and for the destruction of packing material, &c. likely to be infected. The other Federal States of the Empire issued similar regulations to those above referred to, and on July 31st like action was taken as regards goods from France.

With respect to travellers, regulations were issued on July 7th and 12th, whereby all travellers coming from Russia were subjected to medical supervision at the frontier, and any persons actually suffering from cholera, or presenting symptoms suspicious of cholera, were prevented from proceeding on their journey, and lodged in buildings specially provided for the treatment of such cases, such passengers as were apparently healthy being allowed to proceed on their journey. Like regulations were put in force on the Western frontier. The raft and shipping traffic on the Rivers Memel, Weichsel, Przenza, and Warthe were also placed under sanitary control, and a regular medical examination made of all persons on board any craft plying on these rivers, immediately on their entrance into German territory.

The large numbers of Russian emigrants passing through Prussia on their way to German and Dutch ports were regarded as a source of special danger, as for the most part they came from districts in which cholera had already spread widely. Consequently the Imperial Chancellor wrote on July 15th informing the Government of Prussia of this danger, and pointing out that it was to be apprehended, not only from the emigrants themselves, but from other persons from Russia seeking a cholera-free country, and suggesting a regulation of the traffic. The total prohibition of the entry of emigrants into Prussia was regarded as inadvisable, as it was feared that the effect of such a prohibition would be that the emigrants would evade the regulations by crossing the frontier at unguarded points, and by that means the advantage of their medical supervision at the frontier stations would be lost. On July 18th the Prussian Government issued an order which directed that the transport of emigrants was as far as possible to be carried out by means of special trains, and that stoppages on the way were only to be made where absolutely necessary. At stopping places the emigrants were not to be permitted to leave the carriages or to communicate with the rest of the public. The trains were to be provided with all necessaries for the emigrants. Where the forwarding of such persons by special trains could not be carried out, carriages were to be set apart for their exclusive use,

and measures taken whereby the entering of waiting-rooms, restaurants, and lavatories, on the part of emigrants, was prevented. The carriages, after use, were to be thoroughly cleansed, aired, and disinfected. The railway officials in charge of emigrants were directed to exercise careful supervision over them, and upon the appearance of any case of suspicious illness, to telegraph the fact to the nearest station provided with arrangements for the treatment of such cases, in order to set the infected person down at that place. Special sanitary stations for the service of emigrants were established at Breslau and Schneidemühl and also at the central collecting station at Ruhleben, near Spandau. Similar supervision was to be exercised over the emigrants at Hamburg, Bremen, and Lubeck, as well as at all Prussian places of embarkation from their arrival to their departure by sea. At Hamburg arrangements were made whereby the emigrants were housed in barracks erected upon the America Quay.

The first news in this country of cholera in Germany was received on August 23rd, when Her Majesty's Consul-General at Hamburg telegraphed to the effect that Asiatic cholera had been officially declared to have broken out severely in that city. It subsequently transpired that although this official notification was made on August 23rd, no less than 447 cases of cholera had occured up to that date, and that of these, 121 had proved fatal.

On August 23rd, 338 fresh attacks and 89 deaths were recorded. The first recognised cases, 2 in number, occurred on August 16th. These were followed by 4 on August 17th, 12 on the 18th, 31 on the 19th, 66 on the 20th, 113 on the 21st, and 249 on the 22nd. The epidemic in Hamburg rapidly increased until on August 27th upwards of 1,000 new cases of cholera were reported to have occurred on that day alone. The daily number of cases remained at about the same figure for the next four days, and then the epidemic gradually declined.

How cholera was introduced into Hamburg has not been definitely ascertained, though two explanations have been attempted, one, that it was brought by Russian Jews, who were housed in large numbers in barracks situate on the America Quay; the other that the disease was introduced by vessels from Havre where cases of cholera had been occurring since the middle of July.

As soon as the disease was established in Hamburg, a great number of the inhabitants fled, and thus distributed it to many places in the Empire. From Hamburg cholera spread in the first instance to the districts immediately contiguous in which persons resided who worked at Hamburg. The adjoining town of Altona was invaded on August 19th and during the first week of the epidemic, in addition to Altona, the county (Kreis) of Lauenberg on the north bank and that of Harburg on the south bank of the Elbe, were also attacked, but during the second week when large numbers of the inhabitants had left Hamburg by rail, by road and river, no less than 38 new counties, or county towns (Kreise and Stadt Kreise) were invaded. The greater number of these newly attacked districts were either riparian to the River Elbe or situate in the neighbouring province of Schleswig and the States of Mecklenburg Schwerin and Mecklenburg Strelitz. In nearly every instance the initial case was traceable to fugitives from Hamburg, and in this manner some parts of the Empire at a great distance from that city were invaded, as for example Berlin, Bremen on the Weser, Koblenz on the Rhine, Iburg, and Osnabrück in the province of Osnabrück, Gross Strelitz and Leobschutz in the district of Oppeln, Krotoschin in that of Posen, Ostkreis in Sachsen-Altenburg, and Leipzig in Saxony.

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Wismar
Gastrow
Schwerin
Parchim
West
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Prignitz
Osterburg
Stendal
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I
Magdeburg
Wanzleben
Zerbst
Kalbe
Bernburg
Köthen
Dessau
Halle
Querfurt
Leipzig
Apolda
Naumburg
Plauen
Zeitz
Hof
Stein
Hohenleuben
Plauen

During the third week 35 new counties or county towns were invaded by cholera, and of these it is to be observed that the great majority of the newly-invaded places were adjacent to districts already invaded, or where this was not the case the infection was traced to fugitives from Hamburg. An exception to this was observed at Duisburg where it was stated that cholera was introduced by a vessel from Dordrecht. During the period in question cholera was introduced into Greifswald, in the province of Stralsund, near the mouth of the Oder on August 31st, its introduction having been traced to Hamburg. On September 3rd it appeared at Lübzin, on the right bank of the Oder, in the county of Naugard, and on September 5th at Grabow, on the left bank of the Oder, close to the town of Stettin. In the following week, on September 8th, Stettin itself became infected. After the third week the march of the disease in Germany was much slower, the places newly invaded being few in number, and in the great majority of cases being adjacent to the districts already attacked the only notable exception being certain districts situate on the Weichsel (Vistula) which were invaded in the second half of October, and here the disease is said to have been directly introduced by raftsmen from the adjoining infected districts of Russia.

In the following Table XXVII. the date of invasion by cholera of the several counties and towns in Germany from the commencement of the epidemic to November 19th, 1892, are given, together with the population and the numbers of cases and deaths recorded. In Map XI. the march of cholera month by month in the German Empire during 1892 is shown graphically. Detailed statistics as to the several places invaded by cholera are given in Table C appended to this report.

Table XXVII.

Cholera in Germany 1892 (from the Commencement of the Epidemic to November 19th, 1892).

State or Government District.	County (Kreis) or County Town (Stadt Kreis).	Date of first recorded Case of Cholera.	Number of Places invaded.	Population Census, 1890.	Number of Cholera		Rate per 10,000 of the Population. Cholera		Deaths per cent. of Cases (Fatality).
					Cases.	Deaths.	Cases.	Deaths.	
Hamburg	Hamburg	Aug. 16	1	622,530	16,956	8,605	272·5	138·2	50·8
Schleswig	Altona	„ 19	1	143,249	572	328	39·9	22·9	57·4
„	Lauenburg	„ 21	5	48,874	48	28	9·8	5·7	58·4
Lüneburg	Harburg	„ 21	12	36,730	161	89	43·8	27·0	55·3
Schleswig	Pinneberg	„ 23	23	75,377	66	31	8·75	4·1	47·0
Lüneburg	Uelzen	„ 24	1	44,833	4	1	0·9	[0·2]	25·0
Stade	Kehdingen	„ 24	7	21,014	53	31	25·2	14·8	58·5
Potsdam	West Prignitz	„ 25	6	72,697	28	14	3·85	1·9	50·0
Schleswig	Kiel (town)	„ 25	1	69,172	21	11	3·0	1·6	52·3
„	Rendsburg	„ 25	3	58,086	17	12	2·9	2·1	70·7
„	Norderdithmarschen.	„ 25	1	36,439	1	1	[0·3]	[0·3]	—
„	Stormarn	„ 25	18	79,570	114	70	14·3	8·8	61·4
Lüneburg	Winsen	„ 25	3	28,800	5	3	2·1	1·3	—
Stade	Jork	„ 25	14	29,899	90	44	43·0	21·0	48·9
Osnabrück	Osnabrück (town).	„ 25	1	39,929	1	1	[0·25]	[0·25]	—
Mecklenburg-Schwerin.	Ludwigslust	„ 25	5	47,474	22	10	4·6	2·1	45·5
Magdeburg	Salzwedel	„ 26	1	51,061	1	1	[0·2]	[0·2]	—
Sachsen	Leipzig	„ 26	1	295,025	2	1	0·07	[0·03]	—
Mecklenburg-Schwerin.	Boizenburg	„ 26	5	51,252	43	22	8·4	4·3	51·1
Mecklenburg-Strelitz.	Schönberg	„ 26	1	15,350	3	2	2·0	1·3	—
Oldenburg	Delmenhorst	„ 26	1	26,153	1	1	[0·4]	[0·4]	—

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State or Government District.	County (Kreis) or County Town (Stadt Kreis).	Date of first recorded Case of Cholera.	Number of Places invaded.	Population Census, 1890.	Number of Cholera		Rate per 10,000 of the Population. Cholera		Deaths per cent. of Cases (Fatality).
					Cases.	Deaths.	Cases.	Deaths.	
Oppeln - -	Grosz Strehlitz	Aug. 27	1	67,391	2	1	0·3	[0·15]	—
„ - -	Leobschütz -	„ 27	1	86,948	1	—	[0·1]	0·0	—
Lüneburg -	Lüneburg -	„ 27	2	19,940	4	3	2·0	1·5	—
„ -	Harburg (town)	„ 27	1	34,835	22	13	6·3	3·7	59·1
Osnabrück -	Iberg - -	„ 27	1	24,810	1	1	[0·4]	[0·4]	—
Mecklenburg-Schwerin.	Rostock (town)	„ 27	1	44,409	4	2	0·9	0·45	—
Mecklenburg-Strelitz.	Neustrelitz -	„ 27	3	5,789*	4	4	6·9	6·9	—
Posen - -	Krotschin -	„ 28	1	42,971	1	1	[0·2]	[0·2]	—
Magdeburg -	Magdeburg (town).	„ 28	1	202,234	11	6	0·5	0·3	54·5
Schleswig -	Kiel - -	„ 28	4	51,147	4	3	0·8	0·6	—
Stade - -	Rotenburg -	„ 28	1	19,042	1	1	[0·5]	[0·5]	—
Mecklenburg-Schwerin.	Butzow - -	„ 28	3	11,708*	4	1	3·4	[0·8]	—
Sachsen-Altenburg.	Ostkreis -	„ 28	1	88,422	1	1	[0·1]	[0·1]	—
Bremen -	Bremen - -	„ 28	1	125,684	6	6	0·5	0·5	—
„ -	Bremerhaven -	„ 29	1	16,414	1	1	[0·6]	[0·6]	—
Berlin - -	Berlin - -	„ 29	1	1,578,794	32	15	0·2	0·1	46·9
Schleswig -	Husum - -	„ 29	1	36,042	1	—	[0·3]	0·0	—
„ -	Oldenburg -	„ 29	1	43,326	1	1	[0·2]	[0·2]	—
„ -	Steinburg - -	„ 29	9	67,439	24	13	3·6	1·9	54·2
Lüneberg -	Bleckede -	„ 29	2	20,962	2	2	1·0	1·0	—
Koblenz -	Koblenz (town)	„ 29	1	32,664	5	3	1·5	0·9	—
Potsdam -	Charlottenburg (town).	„ 30	1	76,859	8	5	1·0	0·65	—
Magdeburg -	Wolmirstedt -	„ 30	1	51,976	1	—	[0·2]	0·0	—
Schleswig -	Schleswig -	„ 30	3	61,606	3	1	0·5	[0·2]	—
Hildesheim -	Marienburg -	„ 30	1	37,235	2	2	0·5	0·5	—
Stade - -	Neuhaus -	„ 30	4	29,111	5	3	1·7	1·0	—
Mecklenburg-Schwerin.	Malchin -	„ 30	1	47,355	3	3	0·6	0·6	—
Mecklenburg-Strelitz.	Neubrandenburg (town).	„ 30	1	9,323	5	—	5·3	0·0	—
Stralsund -	Greifswald -	„ 31	2	38,244	2	2	0·5	0·5	—
Magdeburgh -	Kalbe - -	„ 31	2	99,857	2	1	0·2	[0·1]	—
Schleswig -	Plon - -	„ 31	1	59,396	1	—	[0·2]	0·0	—
Hildesheim -	Hildesheim (town).	„ 31	1	33,481	3	1	0·6	[0·3]	—
Lüneburg -	Dannenberg -	„ 31	3	14,237	5	5	3·5	3·5	—
Stade - -	Stade - -	„ 31	4	35,359	9	5	2·5	1·4	—
Braunschweig	Helmstedt -	„ 31	1	65,501	1	1	[0·15]	[0·15]	—
Lübeck -	Lübeck - -	„ 31	1	76,485	6	3	0·8	0·4	—
Potsdam -	Westhavelland -	Sept. 1	2	59,067	7	4	1·2	0·7	—
Hildesheim -	Zellerfeld -	„ 1	1	29,100	1	1	[0·3]	[0·3]	—
Potsdam -	Templin -	„ 2	1	45,236	1	1	[0·2]	[0·2]	—
„ -	Niederbarnim -	„ 2	6	165,527	7	4	0·4	0·2	—
Koslin - -	Stolp - -	„ 2	1	74,900	1	—	[0·1]	0·0	—
Magdeburg -	Jerichow II. -	„ 2	3	55,717	4	4	0·7	0·7	—
Schleswig -	Eiderstedt -	„ 2	1	16,002	1	1	[0·6]	[0·6]	—
„ -	Tondern -	„ 2	1	55,067	1	—	[0·2]	0·0	—
Minden -	Bielefeld (town)	„ 2	1	39,950	1	—	[0·25]	0·0	—
Mecklenburg-Schwerin.	Wismar - -	„ 2	1	49,106	3	2	0·6	0·4	—
„ „ -	Gnoien - -	„ 2	1	2,474*	3	2	12·1	8·1	—
Stettin - -	Naugard -	„ 3	1	54,298	6	2	1·1	0·4	—
Hannover -	Hannover (town)	„ 3	1	163,583	2	1	0·1	[0·06]	—
Mecklenburg-Schwerin.	Güstrow -	„ 3	1	47,225	1	—	[0·2]	0·0	—
Oldenburg -	Fürstenthum Lübeck.	„ 3	1	34,718	2	—	0·6	0·0	—
Schleswig -	Segeberg -	„ 4	2	38,067	4	2	1·0	0·5	—
Hannover -	Syke - -	„ 4	1	35,731	2	—	0·6	0·0	—
Lüneburg -	Burgdorf -	„ 4	1	35,706	1	—	[0·3]	0·0	—
Stettin - -	Randow -	„ 5	9	115,412	21	15	1·8	1·3	71·4
Dusseldorf -	Kleve - -	„ 5	1	52,724	1	1	[0·2]	[0·2]	—
Stettin - -	Stettin (town) -	„ 8	1	116,228	28	17	2·4	1·5	60·7
Potsdam -	Spandau (town)	„ 9	1	45,365	4	4	0·9	0·9	—
Bromberg -	Kolmar - -	„ 9	1	60,057	1	—	[0·2]	0·0	—
Magdeburg -	Wanzleben -	„ 10	2	77,854	3	2	0·4	0·3	—
Potsdam -	Oberbarnim -	„ 11	2	84,018	7	6	0·8	0·7	—
Schleswig -	Süderdithmarschen.	„ 11	1	43,883	1	—	[0·2]	0·0	—

* Population of invaded towns or villages only.

State or Government District.	County (Kreis) or County Town (Stadt Kreis).	Date of First recorded Case of Cholera.	Number of Places invaded.	Population Census. 1890.	Number of Cholera		Rate per 10,000 of the Population. Cholera		Deaths per cent. of Cases (Fatality).
					Case	Deaths.	Cases.	Deaths.	
Sachsen Weimar.	Weimar -	Sept. 11	1	66,455	1	—	[0·15]	0·0	—
Mecklenburg-Schwerin.	Gadebusch -	„ 13	1	2,151*	1	1	[4·6]	[4·6]	—
Stettin -	Ueckermünde -	„ 13	4	50,793	24	18	4·7	3·55	75·0
Dusseldorf -	Krefeld (town)	„ 14	1	105,376	1	—	[0·1]	0·0	—
Potsdam -	Augermünde -	„ 15	3	64,704	4	4	0·6	0·6	—
Frankfurt -	Landsberg (town).	„ 17	1	28,065	1	1	[0·4]	[0·4]	—
Stade - -	Achin - -	„ 18	1	20,981	5	4	2·4	1·9	—
Aurich - -	Wittmund -	„ 19	1	47,275	1	—	[0·2]	0·0	—
Frankfurt -	Frankfurt on Oder (town).	„ 20	1	55,738	1	—	[0·2]	0·0	—
Stettin - -	Greifenberg -	„ 22	1	35,039	1	1	[0·3]	[0·3]	—
Magdeburg -	Stendal - -	„ 22	1	62,383	2	2	0·3	0·3	—
Hannover -	Hoya - -	„ 22	1	25,579	3	—	0·8	0·0	—
Stettin - -	Geifenhagen -	„ 23	2	50,737	9	8	1·8	1·6	—
Dusseldorf -	Duisburg (town)	„ 24	1	59,285	1	1	[0·2]	[0·2]	—
Frankfurt -	Königsberg -	„ 25	4	97,822	8	8	0·8	0·8	—
Koblenz -	St. Goar -	„ 27	1	39,055	1	1	[0·3]	[0·3]	—
„ -	Mayen - -	„ 28	3	63,938	18	8	2·8	1·25	44·4
Potsdam -	Osthavelland -	Oct. 1	1	67,606	1	1	[0·15]	[0·15]	—
Stettin - -	Saatzig - -	„ 2	1	44,250	1	1	[0·2]	[0·2]	—
„ -	Usedom Wollin	„ 4	1	49,035	1	1	[0·2]	[0·2]	—
Frankfurt -	Lebus - -	„ 5	1	92,404	1	—	[0·1]	0·0	—
Stralsund -	Stralsund (town)	„ 6	1	27,814	1	1	[0·4]	[0·4]	—
Stettin -	Dammin -	„ 7	1	46,288	3	3	0·65	0·65	—
Wiesbaden -	Frankfort on Maine (town).	„ 7	1	179,985	3	3	0·2	0·2	—
Hessen -	Bingen - -	„ 7	1	3,713	1	—	[2·7]	0·0	—
Baden - -	Karlsruhe -	„ 10	1	31,903	1	1	[0·3]	[0·3]	—
Anhalt - -	Zerbst - -	„ 10	1	47,105	1	—	[0·2]	0·0	—
Marienwerder	Thorn - -	„ 15	2	60,526	4	4	0·7	0·7	—
Koblenz -	Koblenz - -	„ 17	1	58,011	1	—	[0·2]	0·0	—
Marienwerder	Kulm - -	„ 18	2	45,711	9	1	2·0	[0·2]	—
Sachsen -	Flöha - -	„ 23	1	80,144	5	3	0·6	0·4	—
Marienwerder	Stuhm - -	„ 30	1	36,085	1	1	[0·3]	[0·3]	—
„	Marienwerder -	Nov. 9	1	63,675	1	1	[0·2]	[0·2]	—
	Totals - - - -		269	8,542,626	18,625	9,563	21·8	11·2	51·3

* Population of invaded towns or villages only.

As has been observed in other epidemics, the disease spread most rapidly by the water-ways. Taking, for example, the Elbe, cholera appeared at Hamburg on August 16th, and it invaded several counties and towns situate on both north and south banks of the river, almost without exception in exact chronological order both above and below Hamburg. Following the course of the river to the sea, on the right bank, the town of Altona was invaded on August 19th, the county of Pinneberg on August 23rd, that of Steinburg on August 29th, and that of Suderdithmarschen on September 11th; whilst on the opposite bank Harburg was invaded on August 21st, Jork on August 25th, and Kehdingen on August 24th. Above Hamburg on the right bank Lauenburg was invaded on August 21st, Boizenburg on August 26th, Ludwigslust and West Prignitz on August 25th, Jerichow II. on September 2nd, and Zerbst on September 10th. On the left bank, Winsen was attacked on August 25th, Lüneburg on August 27th, Bleckede on August 29th, and Dannenberg on August 31st. Taking the whole epidemic, no less than 23 counties riparian to the Elbe, comprising 111 separate places, were invaded by cholera.

On the River Oder it has already been noted that cholera appeared in the county of Naugard on September 3rd and in that of Randow on September 5th, the town of Stettin being invaded on the 8th of the

same month. Down the river the disease spread to Ukermünde on September 13th, and to Usedom-Wollin on October 4th. Up the river, on the right bank, Greifenhagen and Königsberg were invaded on September 23rd and 25th respectively; on the left bank Augermünde was invaded on September 15th, Lebus on October 5th, and Frankfort-on-the-Oder on September 20th. During the whole period under review, 10 counties or towns riparian to the Oder, comprising 27 separate places, were invaded by cholera.

On the Rhine, cholera was first introduced by fugitives from Hamburg into Koblenz (August 29th), Kleve (September 5th), and Krefeld (September 14th), and was imported into Duisburg from Dordrecht on September 24th. Cases followed on Rhine boats at St. Goar (September 27th), Mayen (September 28th), and Bingen (October 7th).

During the whole period from the commencement of the epidemic at Hamburg on August 16th, 1892, to November 19th of the same year, when it was practically over, 269 places in Germany were invaded. The total number of persons recorded to have been attacked by cholera during the period in question was 18,625, and of these 9,563 died. These numbers are equivalent to an attack-rate of 21·8, and to a death-rate of 11·2 per 10,000 of the aggregate population (8,542,626) of the counties and towns invaded. Upon an examination of the figures given in Table XXVIII., it will be observed that of these no less than 16,956 attacks and 8,605 deaths took place at Hamburg, figures equivalent to an attack-rate of 263·2, and a death-rate of 134·4 per 10,000 of the estimated population.

Upon reference to Table C. appended to this report it will be seen that in the great majority of the remaining 268 places in Germany, invaded by cholera in 1892, the disease did not become epidemic, but on the contrary was frequently limited to one case only.

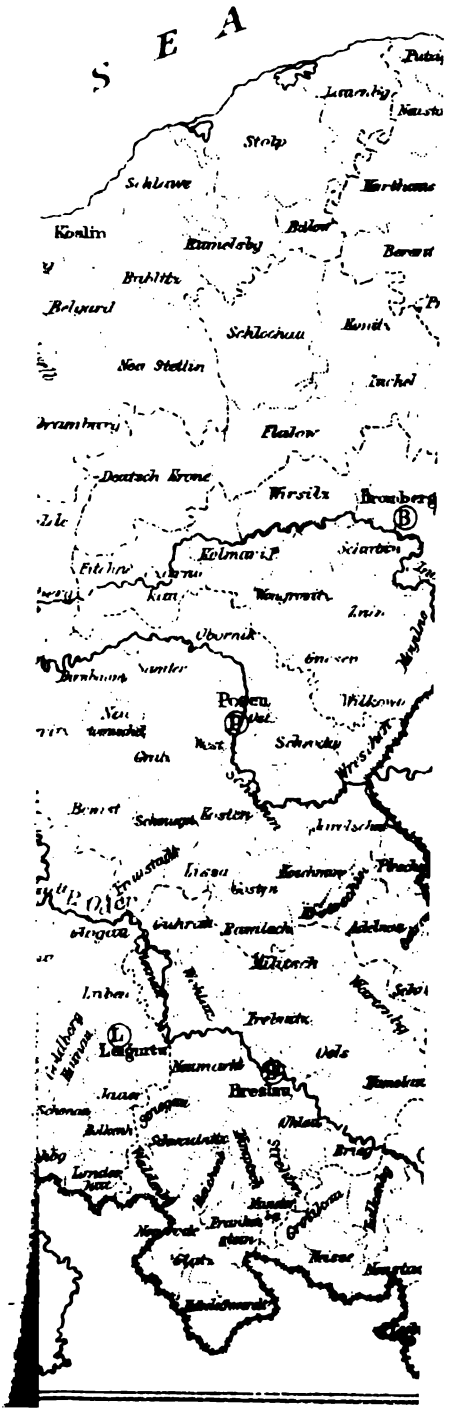
The relative mortality from cholera in the several Counties (Kreise) of Germany is shown geographically in Map XII.

The chief centres of the disease in the German Empire in 1892 are given in Table XXVIII..

Table XXVIII.

Showing the Chief Centres of Cholera in the German Empire in 1892.

Government District or State.	County.	Town.	Population.	Number of Cholera		Rate per 10,000 of Population Cholera		Deaths per cent. of recorded Attacks. "Fatality."
				Attacks.	Deaths.	Attacks.	Deaths.	
Hamburg	- - -	Hamburg -	637,686	16,956	8,605	263·2	134·4	50·6
	- - -	Altona -	143,249	572	328	40·0	22·9	57·4
Schleswig	Lauenburg -	Lauenburg -	5,101	43	25	84·3	49·0	58·1
	- - -	Kiel - -	69,172	21	11	3·0	1·6	52·3
	Rendsburg -	Rendsburg -	13,115	15	11	11·4	8·3	73·4
	Stormarn -	Wandsbeck -	20,571	64	43	30·6	20·9	67·2
Lüneburg	Harburg -	Altenwerder -	1,945	16	10	82·2	51·4	62·5
	„ -	Wilhelmsburg	8,768	116	61	132·4	69·6	52·5
	- - -	Harburg -	34,835	22	13	6·3	3·7	59·1
Stade	Kehdingen -	Bützfleth -	2,331	14	9	60·1	38·6	64·3
	Jork - -	Krautsand -	1,155	12	7	103·8	60·5	58·3
		Neuenfelde -	1,829	43	21	235·0	114·8	48·8
Potsdam	West Prignitz	Wittenberge -	12,590	21	8	16·7	6·4	38·1
Berlin (City of)	- - -	Berlin -	1,579,244	32	15	0·2	0·1	46·9
Stettin	- - -	Stettin -	116,228	28	17	2·4	1·5	60·7
	Ueckermünde	Ueckermünde	6,112	12	11	19·6	18·0	91·6
Mecklenburg-Schwerin.	Boizenburg -	Boizenburg -	3,829	38	19	99·2	49·6	50·0

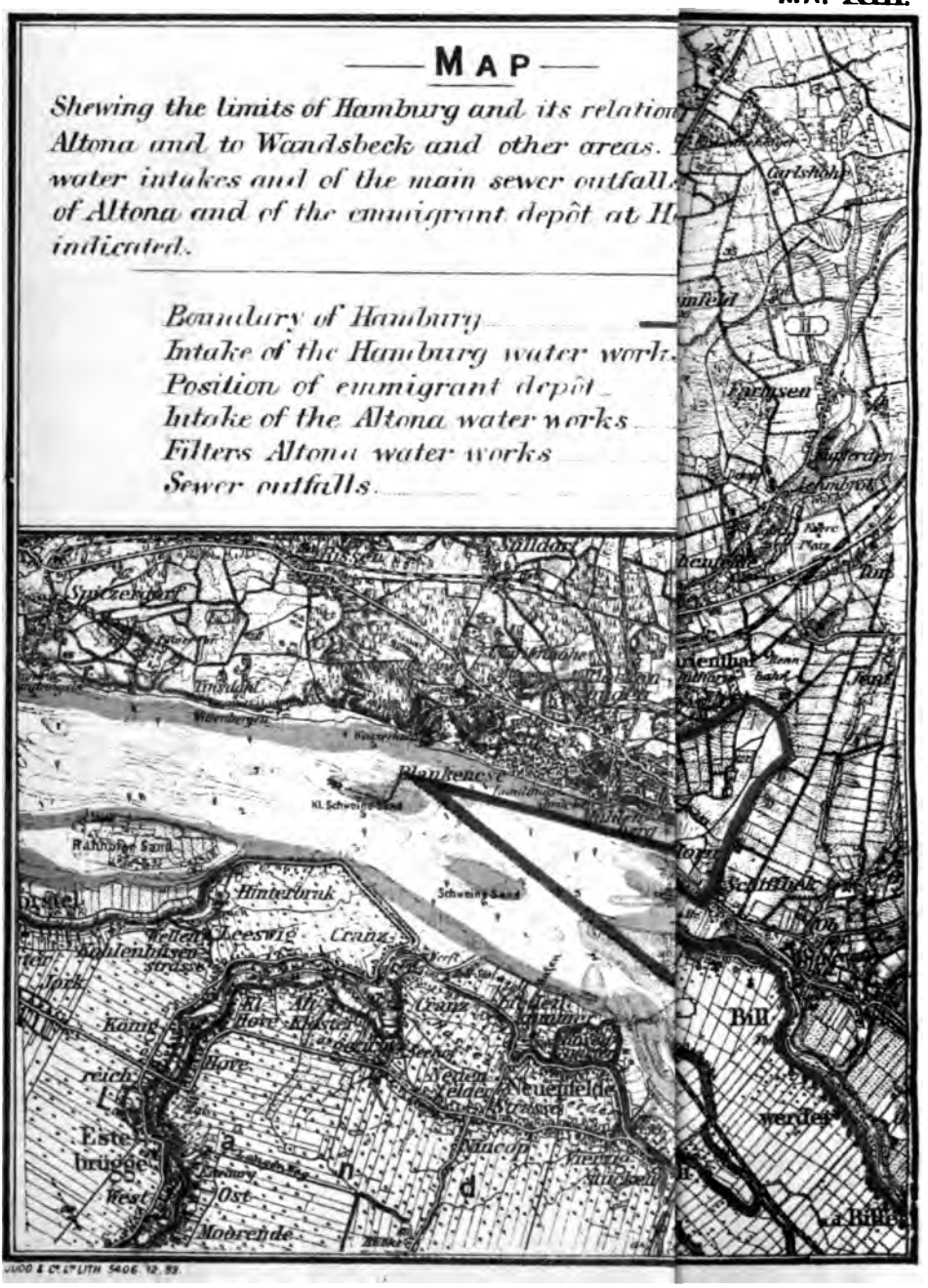

S E A
Stolp
Schlawe
Köslin
Rummelsby
Bütow
Bahlitz
Belgard
Schlochau
Neu Stettin
Deutsch Krone
Wirsitz
Bromberg
Kolmar i. P.
Schubin
Posen
Schrimm
Wreschen
Lissa
Fraustadt
Gostyn
Rawitsch
Glogau
Liegnitz
Neumarkt
Breslau
Wohlau
Brieg
Oppeln
Neustadt
Brandenburg
Glatz
Neisse
Neustadt

MAP XIII.

MAP

Shewing the limits of Hamburg and its relation
Altona and to Wandsbeck and other areas.
water intakes and of the main sewer outfall
of Altona and of the emmigrant depôt at H
indicated.

Boundary of Hamburg
Intake of the Hamburg water works
Position of emmigrant depôt
Intake of the Altona water works
Filters Altona water works
Sewer outfalls



Of all places in Germany, whether regard is had to gross numbers or to the proportions as to population, Hamburg suffered most severely from cholera in 1892, and from Table XXIX. it will be observed that although Hamburg had frequently suffered from invasion of the disease in previous years, the number of deaths and their proportion to the population were much greater in 1892 than had been recorded on any former occasion.

TABLE XXIX.

SHOWING the TOTAL NUMBER of CHOLERA ATTACKS and DEATHS recorded in the several CHOLERA EPIDEMICS in HAMBURG since 1831, with the Rates per 10,000 of the Population.

Year.	Dates of Commencement and of Termination of Epidemic.	Population.	Number of recorded Cholera		Rate per 10,000 of Population. Cholera		Deaths per cent. of recorded Attacks. "Fatality."
			Attacks.	Deaths.	Attacks	Deaths.	
1831	Oct. 5, 1831—Jan 24, 1832 -	173,943	910	498	51·1	28·6	53·0
1832	Feb. 2—Dec. 17 - -	175,220	3,349	1,652	191·1	94·3	49·3
1848	Sept. 1—Dec. 31 - -	210,024	3,687	1,765	175·6	74·5	47·9
1849	May 14, 1849—Jan. 8, 1850 -	208,959	1,191	593	57·0	28·4	49·8
1850	July 26, 1850—Jan. 11, 1851	210,710	794	440	37·7	20·9	55·4
1853	June 23—Oct. 29 - -	225,102	558	301	24·8	13·4	53·9
1854	June 14—Nov. 14 - -	228,952	478	311	20·9	13·6	65·0
1855	June 30—Oct. 22 - -	231,604	353	204	15·2	8·8	57·8
1856	June 13—Nov. 14 - -	233,880	121	78	5·2	3·3	64·5
1857	June 9—Nov. 27 - -	237,043	765	491	32·3	20·7	64·1
1859	June 9—Oct. 5 - -	245,095	2,586	1,285	105·5	52·4	49·7
1866	June 30—Oct. 22 - -	273,484	2.254	1,158	82·4	42·3	51·3
1871	August 1—Sept. 24 - -	324,161	175	141	5·3	4·3	80·5
1873	June 14—Nov. 8 - -	348,127	1,720	1,005	50·0	28·9	58·4
1892	August 16—Nov. 14 -	637,686	16,956	8,605	263·2	134·4	50·6

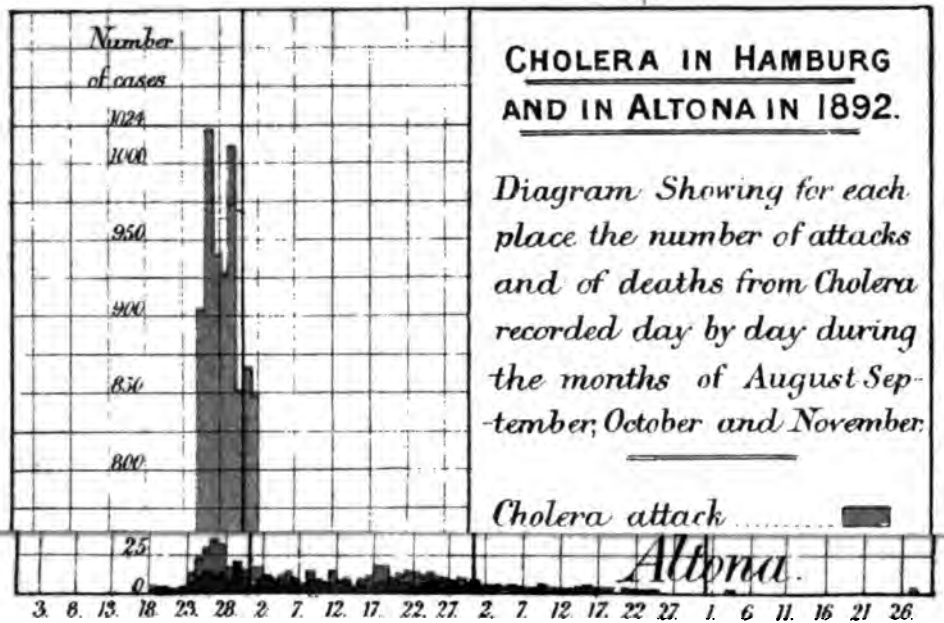
Although this report does not profess to deal with the reasons for the exceptional incidence of cholera in particular localities, the epidemic which took place in Hamburg was of such exceptional dimensions that I propose to refer briefly to the conclusions of Professor Koch and Dr. Reincke as to the diffusion of cholera in Hamburg and Altona. As already stated, cholera was first recognised in Hamburg on August 16th, and in Altona on August 19th, but the subsequent course of the disease in these two adjoining places which, as will be seen from Map XIII. practically form one town, was very different. In Hamburg, the progress of cholera was so rapid as to be startling. From the following Table XXX., in which is given the daily record of cholera cases and deaths during the epidemic of 1892, at Hamburg, as reported by Dr. Reincke, it appears that the number of new cases rose from 477 in the first week to 5,092 in the second, and to 5,587 in the third, after which the weekly numbers gradually declined until the middle of November, when the epidemic was practically over. During the whole period 16,956 cases and 8,605 deaths from cholera were recorded, figures equivalent to an attack-rate of 263, and a death-rate of 134 per 10,000 of the population.

Table XXX.

Daily Record of Cholera Cases and Deaths during the Epidemic of 1892 at Hamburg.

Day of Month.	Number of Cholera		Week ending	Number of Cholera		Day of Month.	Number of Cholera		Week ending	Number of Cholera	
	Cases.	Deaths.		Cases.	Deaths.		Cases.	Deaths.		Cases.	Deaths.
Aug. 16	2	—				Oct. 4	17	10			
„ 17	4	2				„ 5	13	7			
„ 18	12	—				„ 6	6	2			
„ 19	31	8	Aug. 22	477	121	„ 7	9	6	Oct. 10	69	39
„ 20	66	24				„ 8	15	5			
„ 21	113	17				„ 9	8	5			
„ 22	249	70				„ 10	1	4			
„ 23	338	89				„ 11	14	2			
„ 24	358	107				„ 12	2	5			
„ 25	608	218				„ 13	5	3			
„ 26	903	313	„ 29	5,092	2,023	„ 14	8	4	„ 17	39	21
„ 27	1,024	441				„ 15	3	3			
„ 28	936	427				„ 16	4	2			
„ 29	925	428				„ 17	3	2			
„ 30	1,006	537				„ 18	1	2			
„ 31	850	435				„ 19	3	—			
Sept. 1	863	444				„ 20	—	2			
„ 2	843	561	Sept. 5	5,587	3,176	„ 21	1	1	„ 24	8	6
„ 3	732	426				„ 22	2	—			
„ 4	664	402				„ 23	1	3			
„ 5	627	371				„ 24	—	—			
„ 6	446	308				„ 25	—	2			
„ 7	430	257				„ 26	—	—			
„ 8	362	249				„ 27	—	1			
„ 9	337	202	„ 12	2,568	1,566	„ 28	—	—	„ 31	1	3
„ 10	351	185				„ 29	—	—			
„ 11	325	197				„ 30	—	—			
„ 12	317	168				„ 31	1	—			
„ 13	241	170				Nov. 1	1	—			
„ 14	286	125				„ 2	—	2			
„ 15	294	141				„ 3	—	—			
„ 16	344	167	„ 19	1,908	972	„ 4	1	—	Nov. 7	2	2
„ 17	285	130				„ 5	—	—			
„ 18	221	143				„ 6	—	—			
„ 19	237	126				„ 7	—	—			
„ 20	192	112				„ 8	—	—			
„ 21	171	94				„ 9	2	—			
„ 22	160	59				„ 10	—	—			
„ 23	134	96	„ 26	927	516	„ 11	2	—	„ 14	5	—
„ 24	109	59				„ 12	1	—			
„ 25	91	52				„ 13	—	—			
„ 26	70	44				„ 14	—	—			
„ 27	69	45									
„ 28	58	26									
„ 29	36	27									
„ 30	46	16	Oct. 3	273	158						
Oct. 1	23	22									
„ 2	26	11							Total -	16,956	8,605
„ 3	15	11									

DIAGRAM II.



CHOLERA IN HAMBURG AND IN ALTONA IN 1892.

Diagram Showing for each place the number of attacks and of deaths from Cholera recorded day by day during the months of August September, October and November.

Cholera attack .....

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In Altona, on the other hand, the total attacks recorded to the middle of November were 572 only, and of these 328 were fatal; numbers equivalent to an attack-rate of 40 and a death-rate of 21 per 10,000 of the population. Further, of the cases in Altona, at least 400 are stated to have been brought from Hamburg.

The daily number of attacks and of deaths from cholera in Hamburg and in Altona respectively are shown graphically in Diagram II.

At Wandsbeck, another suburb of Hamburg, a similarly comparatively light incidence to that observed at Altona was noted, the cholera attack-rate being 31 and the death-rate 21 per 10,000 of the population. According to Professor Koch, these three towns which are contiguous to each other, and really form a single community, do not differ in their sanitary circumstances with the single exception of the water-supply.

The water-supply of Hamburg is drawn from the River Elbe, the intake being situate at the point marked 1 in Map XIII., and was at the time of the epidemic distributed to the consumers without being subjected to filtration. As will be observed from Map XIII. (5. 5. 5. 5.) the outfalls of the sewers of Hamburg are situate below the intake of the waterworks, but as the tidal movements of the river are considerable, the water was said to have been pumped at ebb-tide only, so as to reduce the possible contamination from sewage as much as possible.

The water-supply of Altona is likewise drawn from the Elbe, the intake of the waterworks being situate at Blankenese (Map XIII., 3), some 7 miles below the point where the main sewers of Hamburg and Altona discharge into the Elbe. The intake is subject to the tide, the difference between high and low tide being on an average somewhat over 6 feet. During the ebb the waterworks receive the Elbe water of the right bank, which is much contaminated by the town sewage. During the flood they obtain water from the returning stream which is of a much purer quality. The water is pumped to the waterworks at Baursberg (Map XIII., 4), where it passes into depositing tanks, in which it loses a portion of the matter held in suspension, and from thence it passes through filters composed of gravel and sand before being supplied to the public.

At Wandsbeck the water is obtained from a lake, which is hardly at all exposed to contamination from fœcal matter, and this water like that of Altona is subjected to filtration before being supplied to the consumers. It will thus be seen that there was an essential difference at the time of the epidemic between the water supplies of Hamburg, Altona, and Wandsbeck, the water-supply of Hamburg being unfiltered, whilst that of the two last-named places was filtered. As regards the different behaviour of cholera in Hamburg and Altona, I may usefully quote the observations of Professor Koch contained in his paper* on "Wasser-filtration und Cholera."

> "Most surprising were the conditions of the cholera epidemic along the boundary between Hamburg and Altona. On both sides of the boundary the conditions of soil, buildings, sewerage, population, everything shortly, of importance in this respect, were the same, and yet the cholera in Hamburg went right up to the boundary of Altona, and there stopped. In one street, which for a long way forms the boundary, there was cholera on the Hamburg side whereas the Altona side was free from it. Indeed, in the case of a group of houses on the so-called Hamburger Platz, the cholera

* Separat Abdruck aus der Zeitschrift für Hygiene und Infectionskrankheiten, vierzehnte Band, 1893.—Translated by Albert J. A. Ball, Esq., of the Local Government Board. See Appendix C., page 440, *post*.

marked out the boundary better than anyone having the map of the frontier between Hamburg and Altona before him could have done. The cholera not only marked the political boundary but even the boundary of the water-supply between the two towns. The group of houses referred to, which is thickly populated by families of the working class, belongs to Hamburg, but is supplied with water from Altona; and it remained completely free from cholera, whereas all around on the Hamburg territory there were numerous cases of disease and death. Here we have to do with a kind of experiment which was performed on a population of over 100,000, but which in spite of its immense proportions complied with all the conditions which one requires from an exact and perfect experiment in a laboratory. In two great populations, nearly all the factors are the same—one only is different, and that the water-supply. The population supplied with unfiltered water from the Elbe is seriously visited by cholera; the population supplied with filtered water is only visited by the disease to a very small extent. This difference is all the more important as the water of Hamburg is taken from a place where the Elbe is relatively but little contaminated; whereas Altona resorts to the water of the Elbe after it has received all the liquid and fæcal refuse of 800,000 people. Under these conditions there is no other explanation for the scientific thinker but that the difference in the incidence of the cholera on these two populations was governed by the differences in the water-supply, and that Altona was protected against the cholera by the filtration of the water of the Elbe."

As to the means by which the water-supply of Hamburg became first affected, two theories have been advanced, either of which would account for the specific contamination of the Elbe water. According to the first theory the disease had been brought by Jewish emigrants from Russia, as prior to the commencement of the epidemic upwards of 5,000 Russian Jews, many of them nearly destitute, had recently passed through Hamburg from cholera-stricken provinces in Russia. These persons had been housed in wooden barracks erected on the America Quay. (See Map XIII., 2.) From these buildings the sewage was conveyed into the docks, and as the river is here tidal it is stated that this filth, with other sewage matter, was carried into and up the Elbe at times as far as and beyond the intake of the Hamburg Waterworks. According, however, to a despatch received from Her Majesty's Consul-General at Hamburg, dated September 14th, it appears that no recognised case of cholera occurred amongst the emigrants until 12 days after the disease had shown itself in the city.

According to the second theory cholera was introduced by ships from Havre, where as stated by M. Gibert (Bulletin de l'Académie de Medicine, September 27th, 1892), cases had already been observed since the middle of July. But as regards this, although it is known that vessels from Havre were lying in the river near the dock referred to above, prior to the outbreak in Hamburg no cases of cholera had been recognised on board any of them. It has, however, been suggested that the Elbe water became infected by means of water-ballast, which had been taken from the Seine at Havre and pumped out again into the Elbe.

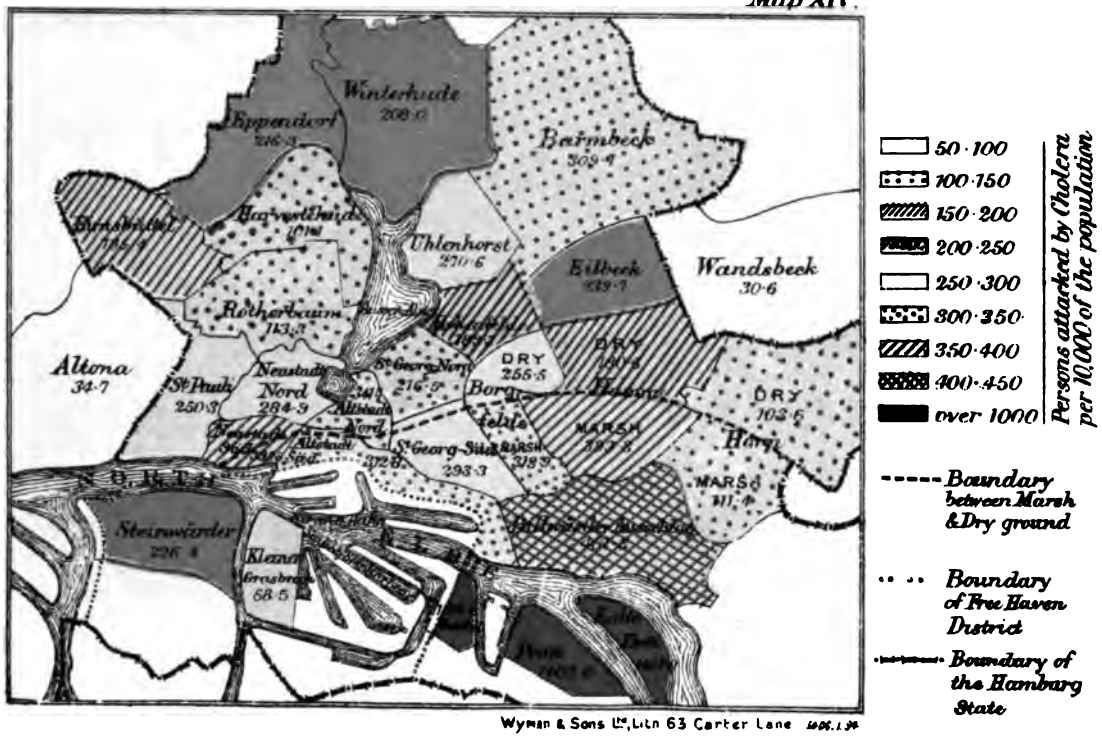
In Dr. Reincke's Report already referred to*, the statistics of cholera in the several sub-districts of Hamburg are fully considered, and in

* See footnote †, page 117, *ante*.

CHOLERA IN HAMBURG IN 1892.

Map shewing the incidence of Cholera attack in each, and in certain groups of the Sub-Districts of Hamburg in 1892, per 10,000 of the Population in each instance.

Map XIV.



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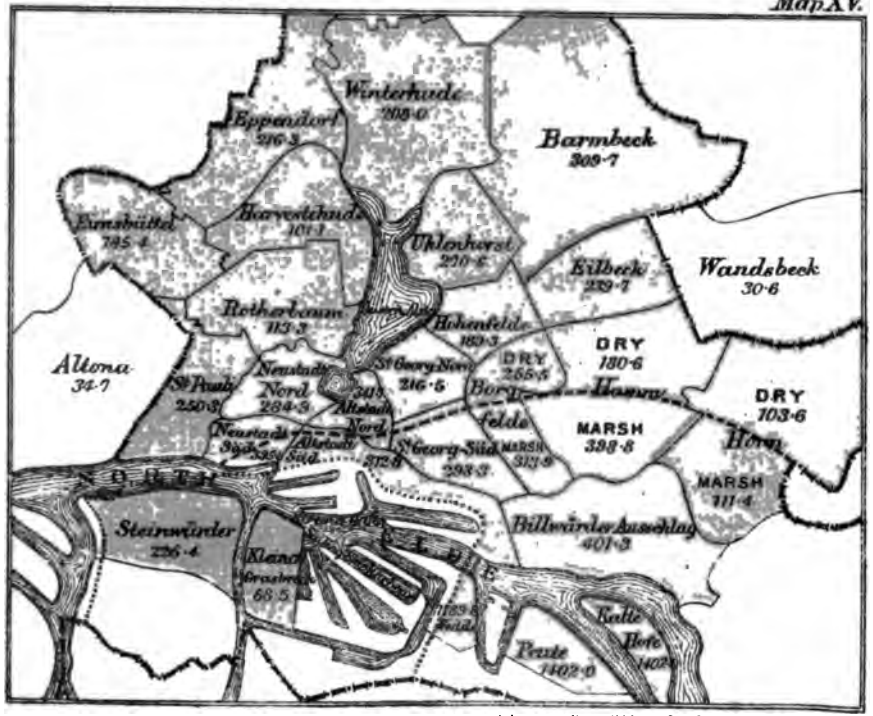
CHOLERA IN HAMBURG IN 1892.

Map showing different intensity of incidence of Cholera attack on certain groups of the Sub-Districts of Hamburg in 1892 per 10,000 of the population.

Map XV.



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Cholera attack rate above mean of Hamburg.

Cholera attack rate below mean of Hamburg.

Mean Cholera attack Hamburg 1892 - 263·2 per 10.000 population.

Boundary between Marsh & Dry ground

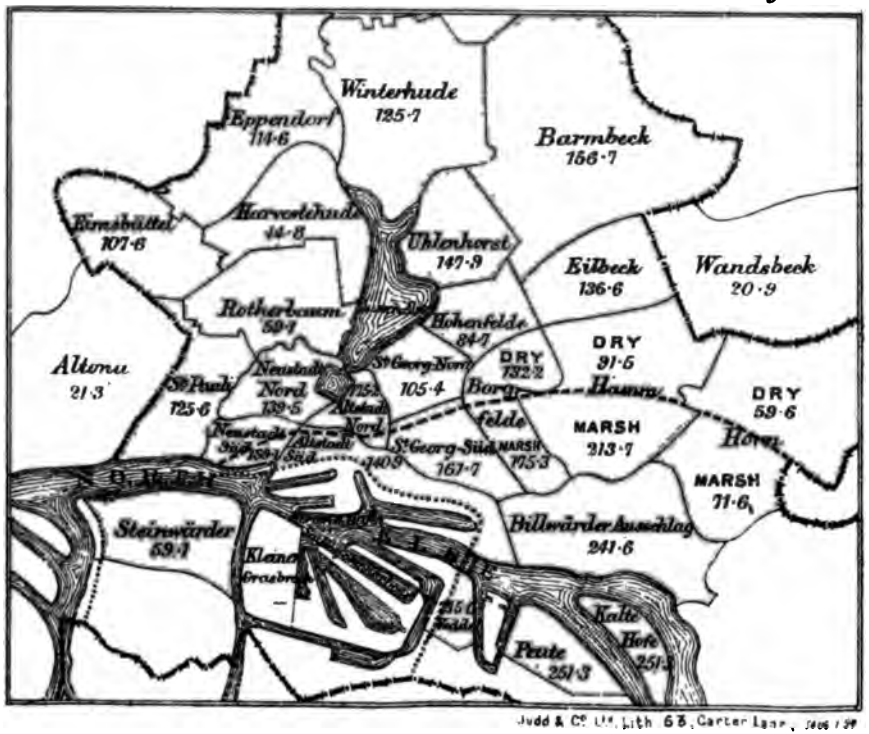
Boundary of Free Haven District.

Boundary of the Hamburg State

CHOLERA IN HAMBURG IN 1892.

Map XVI.

Map showing the different amount of Cholera Mortality, per 10,000 population, in certain groups of the Sub-Districts of Hamburg in 1892.



Cholera death rate above mean of Hamburg

Cholera death rate below mean of Hamburg.

Mean Cholera death rate Hamburg 1892 - 134·4 per 10,000 population.

Boundary between Marsh & Dry ground

Boundary of Free Haven District.

Boundary of the Hamburg State

Table XXXI., adapted from this report, the cholera attack-rates and death-rates for these sub-districts are given. The incidence on these several sub-districts of cholera attack is shown graphically in Maps XIV. and XV., and that of cholera death in Map XVI.

TABLE XXXI.

SHOWING the INCIDENCE during 1892 of CHOLERA ATTACKS and of CHOLERA DEATHS upon the several SUB-DISTRICTS of HAMBURG per 10,000 of the POPULATION.

Name of Sub-District.	Rates per 10,000 of the Population.	
	Cholera Attacks.	Cholera Deaths.
Kleiner Grasbrook	68·5	00·0
Harvesthude	101·1	44·8
Horn	105·8	68·0
Rotherbaum	113·3	59·1
Eimsbüttel	185·4	107·6
Hohenfelde	189·3	84·7
Winterhude	208·0	125·7
Eppendorf	216·3	114·6
St. Georg-Nordentheil	216·5	105·4
Steinwärder	226·4	59·1
Eilbeck	239·7	135·7
St. Pauli	250·3	125·6
Uhlenhorst	270·6	147·9
Borgfelde	273·1	145·4
St. Georg-Südertheil	293·3	161·7
Neustadt Nordertheil	294·0	139·0
Barmbeck	309·7	156·7
Altstadt Südertheil	312·8	140·9
Hamm	314·6	168·2
Altstadt Nordertheil	341·7	175·2
Neustadt Südertheil	395·8	199·1
Billwärder Ausschlag	401·3	241·6
Veddel	1189·8	275·0
Peute and Kalthose	1402·0	251·3
States of Hamburg	**263·2**	**134·4**

By reference to Table XXXI, and to Maps XIV., XV., and XVI., it will be observed that the incidence of cholera in Hamburg was above the mean for that city, chiefly in the sub-districts adjoining the harbour, the only exceptions being the districts of Steinwärder and Kleiner Grassbrook in which they, being for the most part covered by factories, the permanent population was but small. Dr. Reincke in his report discusses the bearing of numerous factors which influenced the incidence of the disease in the several localities. Amongst these he draws special attention to the apparent influence of the nearness of ground-water to the surface as shown by the much greater proportion of persons attacked by cholera in the low-lying portions of the districts of Horn, Hamm, and Borgfelde, as compared with the higher and drier portions of the same districts. The figures as to these differences are given in the following Table XXXII.

Table XXXII.

Showing the Incidence of Cholera in 1892 upon certain Sub-Divisions of some of the Sub-Districts of Hamburg.

Sub-District.		Population.	Number of Cholera		Rates per 10,000 of the Population.	
			Attacks.	Deaths.	Cholera Attacks.	Cholera Deaths.
Borgfelde	Dry	11,177	284	147	255·5	132·2
	Marsh	5,192	163	91	313·9	175·3
Hamm	Dry	4,027	89	45	180·6	91·5
	Marsh	8,329	328	178	393·8	213·7
Horn	Dry	3,185	33	19	103·6	59·6
	Marsh	1,257	14	9	111·4	71·6

Dr. Reincke, however, observes that in addition to the differences of the circumstances of the soil, there were also very great differences in the sanitary circumstances of the inhabitants, and that those living on the high land were chiefly well-to-do people, whilst the marshy parts were almost exclusively inhabited by workmen with large families, and with defective or insufficient house accommodation.

With respect to the water-supply it is of interest to observe that in the isolated suburbs many houses were provided with water from springs. This is especially the case in the sub-districts of Winterhude, Eppendorf, Horn and portions of Eimsbüttel and Barmbeck, and it was observed that persons obtaining their water-supply from such springs enjoyed almost complete immunity from cholera. It is also to be noted that in many of the houses, especially in those inhabited by people of means, water obtained from the Hamburg Waterworks had, as a matter of practice, been boiled previous to use ever since the epidemic of enteric fever which occurred in 1880, and it is stated that this practice became more and more general after August 23rd, the date on which the presence of cholera in Hamburg was first officially declared.

Upon reference to Map XII. in which the relative mortality from cholera in the several counties (Kreise) of the Empire is shown graphically it will be observed that all the places named in Table XXVIII. as having been the chief centres of the disease in 1892, are with the exception of Berlin, Stettin, and Ueckermünde, situate close to Hamburg.

According to the official memorandum prepared by Dr. Koch it would appear that pollution of water by the persons first attacked was to blame for the invasion of several of these places, as, for example, Wilhelmsburg, Neuenfeld, and Harburg. At Lauenburg cholera was introduced on August 21st by a shipowner who had come there by steamer from Hamburg, and who fell ill, with choleraic symptoms, and died that day. The existence of cholera in Hamburg was not then known at Lauenburg, and in consequence the disease remained unrecognised, and no special precautions were taken, the excreta and other infective material from the deceased finding their way unhindered into the Stecknitz, a tributary of the Elbe. This case was followed by others in the neighbourhood who had used the water of the Stecknitz for domestic purposes. The disease was further spread by people coming

from Hamburg by boat or rail, and altogether between August 21st and September 10th there were 43 attacks and 25 deaths.

In like manner at Boizenburg the prevalence of cholera is stated to have been due to the use for drinking purposes of water fouled by cholera dejecta.

The number of cases and of deaths from cholera recorded as having occurred in each State of the German Empire invaded in 1892, together with the populations of the several States, are given in Table XXXIII.

Table XXXIII.

Statistics of Cholera in the several States of Germany invaded by Cholera in 1892 for the period from the commencement of the Epidemic to November 19th, 1892.

State.	Date of First Recorded Case of Cholera.	Number of Places invaded.	Population, Census 1890.	Total Recorded Cholera		Rates per 10,000 Population, Cholera	
				Attacks.	Deaths.	Attacks.	Deaths.
Hamburg	Aug. 16	1	622,530	16,596	8,605	266·5	138·2
Prussia	„ 19	232	29,957,307	1,905	893	0·6	0·3
Mecklenburg-Schwerin.	„ 25	19	578,342	83	41	1·4	0·7
Sachsen	„ 26	2	3,502,684	7	4	0·02	0·01
Mecklenburg-Strelitz.	„ 26	5	95,978	12	6	1·2	0·6
Oldenburg	„ 26	2	354,968	3	1	0·08	[0·03]
Sachsen Altenburg	„ 28	1	170,864	1	1	[0·06]	[0·06]
Bremen	„ 28	2	180,443	7	7	0·4	0·4
Braunschweig	„ 31	1	403,771	1	1	[0·02]	0·02
Lubeck	„ 31	1	76,485	6	3	0·8	0·4
Sachsen Weimar	Sept. 11	1	326,091	1	—	[0·03]	0·0
Hessen	Oct. 7	1	992,883	1	—	[0·01]	0·0
Baden	„ 10	1	1,657,868	1	1	[0·006]	0·006
Anhalt	„ 10	1	271,963	1	—	[0·04]	0·0

Great Britain.

(*a.*) *Scotland.*

Scotland was, in point of date, the first part of Great Britain in which cholera appeared.

On August 19th, a fireman who had arrived at Grangemouth on board the S.S. "Hélène Sauber" from Hamburg on the previous evening was attacked with cholera. This case, which occurred five days prior to the official declaration affirming the presence of cholera in Hamburg, was the first attack recorded to have taken place in the British Islands during 1892.

Upon the arrival of the "Hélène Sauber" at Grangemouth, all hands on board were apparently well. About 3 a.m. on August 19th, the fireman referred to above was seized with diarrhœa and cramps. He was seen by the Medical Officer of Health about 8 a.m., admitted to the Grangemouth town hospital at noon, and died at 2.30 p.m. on the same day. From the clinical symptoms and from the post-mortem examination it was proved that the case had been one of cholera. The vessel was taken out to the Mooring Station, and there cleansed and disinfected. The bedding used by the deceased man while on board ship was burnt, as well as the bedding and all other articles used by him at the hospital.

On the afternoon of Thursday, August 25th, a party of emigrants, 33 in number, arrived in Glasgow by rail, having landed at Leith per S.S. "Weimar" from Hamburg on the same day. The "Weimar" had left Hamburg on August 23rd. The emigrants on their arrival at Glasgow were boarded at the Atlantic Hotel, York Street, where they were immediately inspected by a medical man retained by the shipping companies engaged in the Atlantic emigrant business at Glasgow for the purpose. All at that time were apparently well, but late in the evening of August 26th, two of the number were seized with vomiting and diarrhœa, one a man, three days and twelve hours after leaving Hamburg, the other a woman, five hours later. The Medical Inspector referred to above immediately communicated with the Glasgow Health Authorities, and early on the morning of August 27th both cases were removed to the Belvedere Hospital. In both cases the presence of cholera was confirmed. Both eventually recovered.

The remaining 31 emigrants were placed under the supervision of an "Epidemic Inspector" and an interpreter, and on August 28th they were transferred to the Southern Reception House along with four female servants belonging to the hotel, who had been in various ways exposed to infection from the sick. They were medically inspected every six hours, and means were taken to make sure that no diarrhœal symptoms whatever could elude detection. The interpreter resided in the Reception House as a necessary means of communication. All articles of bedding and clothing which had been exposed to gross soiling and infection were burned, and other articles were disinfected in the usual way. No further cases of cholera occurred amongst the emigrants.

On September 15th, the S.S. "Hélène Sauber" arrived at Grangemouth from Hamburg. Upon medical inspection all hands on board were apparently well, and the vessel was allowed to enter the docks. On the morning of September 16th, however, the second officer was attacked with choleraic symptoms. He was at once removed to the town hospital, and the vessel was taken to the Mooring Station for the

necessary disinfection. The patient subsequently recovered, and no further cases occurred.

For the facts contained in the above account of cholera in Scotland, I am indebted to Dr. Littlejohn, the Medical Officer of the Board of Supervision, and to Dr. J. B. Russell, the Medical Officer of Health for Glasgow.

(*b.*) *England and Wales.*

During the year 1892, notwithstanding the fact that cholera was imported into England from infected Continental ports on several occasions, in no case, so far as is known, was the disease transmitted to any person resident in the kingdom.

In Table XXXIV. a list is given of all the cases of cholera which are recorded as having reached England during 1892. These cases were thirty-five in number, and entered the country at nine ports, namely, London 11, Hull 7, Grimsby 5, Harwich 4, Falmouth 3, River Tees 2, and the River Tyne, River Blyth, and Wisbech, 1 at each. Twenty-one of the cases were reported between August 25th and August 31st, ten during the month of September, and four during the month of October. Of the thirty-five cases eleven proved fatal. It will be observed that these figures are seven in excess of the number noted in the Board's Annual Report; this is due to the fact that upon further investigation some of the cases which were reported at the time to be doubtful, were subsequently proved to be indistinguishable from cholera.

From the Table it will be seen that in 25 of the total 35 persons who were reported to have suffered from cholera, the disease was detected at the port of entry, whilst in the remaining 10, cholera did not declare itself until the persons attacked had left the port of entry, and had travelled elsewhere. Of these 10 cases, 5 transmigrants *en route* for New York, who had entered England at Hull, did not develop cholera until they had reached Liverpool; 3 persons who had landed at Harwich showed no symptoms of the disease until after their arrival in London (2 at Islington and 1 at St. Pancras); a sailor from a cholera-infected ship in the River Tees was attacked after reaching North Shields in the Tynemouth Urban Sanitary District, and another sailor, who had landed at Sutton Bridge (Wisbech Port), was first attacked in a railway carriage a short distance from Bridgewater, whilst on his way to Plymouth.

Of the 35 persons attacked by cholera, 29 had come from Hamburg, 3 from Antwerp, 2 from Rotterdam, and 1 from Solombola, near Archangel.

In the following detailed account of the cases, I propose to refer to them according to the date of their arrival in England, or of their attack by cholera, whichever event occurred the latest in order of time. In order to show the procedure adopted by an efficient Port Sanitary Authority in this country for dealing with cholera, I propose to give a complete account (quoted from a memorandum by Mr. W. H. Power), of the action taken at the Port of London with regard to the S.S. "Gemma," the first vessel coming to England upon which cases of cholera were found in 1892. With regard to the remaining cases, short notes only of the facts observed will be given.

On August 25th the S.S. "Gemma" arrived at Gravesend with immigrants from Hamburg, of whom three had been attacked by cholera before her arrival. It was ascertained that the "Gemma" had sailed from Hamburg on Tuesday, August 23rd, at 1 p.m., having on board seven first-class and eight second-class passengers, along with 66 other persons, namely, a crew of 18, five men in attendance on 30 ponies, and

43 Russian and Polish immigrants, all of them Jews. All went well until 9 a.m. on Thursday, August 25th, when the "Gemma" was abreast the "Sunk" Lightship. At this hour one of the immigrants, an adult, was seized with illness, and within a couple more hours other two immigrants, both adults, were similarly attacked. On arrival at Gravesend at 1.30 p.m. on the same day, the "Gemma" was boarded in due course by the Customs officers, who, having ascertained that there was illness on the vessel, detained her, and upon landing reported the circumstances to Dr. Whitcombe, the acting Port Medical Officer of Health at Gravesend. He boarded the "Gemma" at 2.30 p.m., and found the illness from which the three immigrants were suffering to be cholera. Dr. Collingridge, the Port Medical Officer of Health for London, had been on the look-out for the "Gemma," as a vessel likely to import cholera. He arrived at Gravesend in his launch at 3.15 p.m., and concurring with Dr. Whitcombe as to the nature of the malady on board the "Gemma," ordered that vessel to the Mooring Station appointed for cholera ships, and made arrangements forthwith for the reception of the three cholera cases at the Port Sanitary Authority's Hospital, a mile east of Gravesend. Their transference to hospital was effected by 4 p.m., and their clothing and bedding transferred along with them were at once burnt. In the end all three of these immigrants died: one on Thursday, August 25th, one on Friday, August 26th, and one on Saturday, August 27th.

The first and second-class passengers, the crew, the pony men, and the remaining immigrants were next passed severally under view and were cross-examined as to their state of health. None were found to have symptoms suspicious of cholera, and the first and second-class passengers, each of whom could give a precise address as to his destination for the night, were permitted to land. They were, however, required to leave behind them their baggage which Dr. Collingridge detained for examination and for disinfection, arranging that it should be forwarded later on to the addresses they had given, or to such further addresses as they might supply. Meanwhile Dr. Collingridge communicated to each London Sanitary Authority concerned, the addresses that had been given him in London of these first and second-class passengers, and intimating his reason for doing this.

The immigrants each and all were unable to satisfy Dr. Collingridge as to their addresses in London or elsewhere, and on this account Dr. Collingridge detained them on board the "Gemma," where also he remained for the night, and indeed until late on Saturday, August 27th. During that interval he made an exhaustive examination of their clothing, bedding, and other effects. Next morning, Friday, August 26th, no further cholera cases having developed on board the "Gemma," Dr. Collingridge set to work to overhaul the clothing and effects of the immigrants, organising at the same time a general wash of their bodies and of such articles of their clothing as he did not, on account of their filthiness, condemn to be burnt. Their bedding was burnt in every instance; further Dr. Collingridge took steps to secure suitable accommodation for the immigrants after their washing and disinfection had been accomplished, and until they could supply him with satisfactory statements as to their future addresses in London to which all were bound. Some difficulty was experienced in securing the accommodation desired, and finally the Port Sanitary Authority determined to have the immigrants disposed in tents on a spare couple of acres at the Port Sanitary Hospital site. When this had been accomplished the "Gemma" was thoroughly disinfected, after which she was permitted to enter dock

Table XXXIV.

Cholera in England during 1892.

TABLE XXXIV. CHOLERA in

No. of Case.	Date of Arrival in England (a), or of Attack by Cholera (b), whichever Event occurred latest in Point of Time.	Sanitary District whence Case notified.	Facts wit		
			Name of Vessel.	Port of Departure.	
				Name.	Date.
Col. 1.	2.	3.	4.	5.	6.
	1892.				
1	Aug. 25 (a)	London Port -	"Gemma" -	Hamburg - -	Aug. 23
2	„ 25 (a)	„ „ -	„ -	„ - -	„ 23
3	„ 25 (a)	„ „ -	„ -	„ - -	„ 23
4	„ 27 (b)	River Tees Port -	"Gerona" -	„ - -	„ 25
5	„ 27 (b)	Liverpool Urban -	"Flamingo" -	„ - -	„ 24
6	„ 27 (b)	„ „ -	„ -	„ - -	„ 24
7	„ 27 (b)	„ „ -	„ -	„ - -	„ 24
8	„ 27 (a)	Grimsby Port -	"Talavera" -	„ - -	„ 24
9	„ 27 (a)	„ „ -	„ -	„ - -	„ 24
10	„ 27 (b)	Saint Pancras Urban (London).	"Ipswich" -	Rotterdam -	„ 23
11	„ 29 (b)	Liverpool Urban -	"Flamingo" -	Hamburg - -	„ 24
12	„ 29 (b)	Tynemouth Urban -	"Gerona" -	„ - -	„ 25
13	„ 30 (a)	London Port -	"Hélène" -	„ - -	„ 20
14	„ 30 (a)	„ „ -	„ -	„ - -	„ 20
15	„ 30 (b)	Grimsby Port -	"Talavera" -	„ - -	„ 24
16	„ 30 (b)	Islington Urban (London).	"Peregrine" -	„ - -	„ 28
17	„ 30 (b)	„ „	„ -	„ - -	„ 28
18	„ 31 (b)	Grimsby Port -	"Talavera" -	„ - -	„ 24
19	„ 31 (a)	Falmouth Port -	"Clement" -	„ - -	„ 27
20	„ 31 (a)	„ „ -	„ -	„ - -	„ 27
21	„ 31 (a)	„ „ -	„ -	„ - -	„ 27
22	Sept. 4 (a)	River Tyne Port -	"Elbe" - -	„ - -	Sept. 2
23	„ 5 (a)	Grimsby Port -	"Oldham" -	„ - -	„ 3
24	„ 5 (b)	Liverpool Urban -	"Flamingo" -	„ - -	Aug. 24
25	„ 6 (a)	River Blyth Port -	"Ashington" -	„ - -	Sept. 4
26	„ 15 (a)	London Port	"Elizabeth Alice"	Hamburg viâ Antwerp.	?
27	„ 15 (a)	„ „ -	"Titania" -	Antwerp - -	Sept. 8
28	„ 19 (b)	Hull and Goole Port	"Uranus" -	Hamburg - -	„ 17
29	„ 19 (a)	Harwich Port -	"Adelaide" -	Rotterdam -	„ 18
30	„ 24 (b)	Bridgewater Urban -	"Glenavon" -	Solombola, near Archangel.	„ 9
31	„ 24 (b)	Hull and Goole Port	"Esperanza" -	Hamburg - -	„ 22
32	Oct. 3 (a)	London Port -	"Ben Alder" -	Antwerp - -	Oct. 2
33	„ 6 (b)	„ „ -	„ -	„ - -	„ 2
34	„ 18 (a)	„ „ -	"Biafra" - -	Hamburg - -	„ 15
35	„ 21 (a)	„ „ -	"Hamburg" -	„ - -	„ 18

ENGLAND during 1892.

respect to Vessel.		Facts with respect to Persons attacked with Cholera					
Port of Arrival.		Sex of Patient.	Date of Cholera Attack.	Place of Attack.	Where isolated.	Date of Isolation.	Resu
Name.	Date.						
7.	8.	9.	10.	11.	12.	13.	14
London -	Aug. 25	F.	Aug. 25	At sea - -	London Port Hospital.	Aug. 25	Died Au
„ -	„ 25	F.	„ 25	„ - -	„ „	„ 25	„
„ -	„ 25	M.	„ 25	„ - -	„ „	„ 25	„
River Tees -	„ 27	M.	„ 27	In dock - -	On board vessel	„ 27	„
Hull and Goole	„ 25	F.	„ 27	Lodging-house, 3, Great George Square, Liverpool.	Parkhill Hospital	„ 27	Recover
„ „	„ 25	F.	„ 27	3, Great George Square, Liverpool.	„ „	„ 27	Died Au
„ „	„ 25	M.	„ 27	75, Duke Street, Liverpool.	Brownlow Hill Hospital.	„ 27	Recover
Grimsby -	„ 27	M.	„ 28	At sea - -	Grimsby Port Hospital.	„ 27	„
„ -	„ 27	M.	„ 28	„ - -	„ „	„ 27	„
Harwich -	„ 24	M.	„ 27	90, Cromer Street, Saint Pancras, London.	Royal Free Hospital.	„ 29	„
Hull and Goole	„ 25	M.	„ 29	75, Duke Street, Liverpool.	Parkhill Hospital	„ 29	Died Se
River Tees -	„ 27	M.	„ 29	New Quay, North Shields.	Tynemouth Urban Hospital.	„ 29	Recover
London -	„ 30	M.	„ 22	At sea - -	London Port Hospital.	„ 30	„
„ -	„ 30	M.	„ 23	„ - -	„ „	„ 30	Died Se
Grimsby -	„ 27	M.	„ 30	In dock - -	Grimsby Port Hospital.	„ 30	Recove
Harwich -	„ 29	F.	„ 30	344, City Road, Islington London.	St. Bartholomew's Hospital.	„ 30	„
„ -	„ 29	M.	„ 30	„	„	„ 30	Died A
Grimsby -	„ 27	M.	„ 31	In dock - -	Grimsby Port Hospital.	„ 31	Recove
Falmouth -	„ 31	M.	„ 30	At sea - -	Falmouth Port Hospital.	„ 31	„
„ -	„ 31	M.	„ 30	„ - -	„ „	„ 31	„
„ -	„ 31	M.	„ 30	„ - -	„ „	„ 31	„
River Tyne -	Sept. 4	M.	Sept. 3	„ - -	Tyne Port Hospital.	Sept. 4	Died Se
Grimsby -	„ 5	M.	„ 5	„ - -	Grimsby Port Hospital.	„ 5	Died Se
Hull and Goole	Aug. 25	M.	„ 5	3, Great George Square, Liverpool.	Parkhill Hospital	„ 6	Recove
River Blyth -	Sept. 6	M.	„ 6	At sea - -	South Blyth Urban Hospital.	„ 6	„
London -	„ 15	M.	„ 12	„ - -	On board vessel	—	„
„ -	„ 15	M.	„ 8	„ - -	„ „	—	„
Hull and Goole	„ 18	M.	„ 19	In dock - -	Hull Port Hospital.	Sept. 19	Died Se
Harwich -	„ 19	M.	„ 19	At sea - -	Harwich Port Hospital.	„ 19	Recover
Wisbech -	„ 24	M.	„ 24	On railway near Bridgewater.	Bridgewater Infirmary.	„ 24	„
Hull and Goole	„ 24	M.	„ 24	In dock - -	Hull Port Hospital	„ 24	„
London -	Oct. 3	M.	Oct. 1	At sea - -	On board vessel	Oct. 3	„
„ -	„ 3	M.	„ 6	At Mooring Station	London Port Hospital.	„ 6	„
„ -	„ 18	M.	„ 19	At sea - -	„ „	„ 19	„
„ -	„ 21	M.	„ 19	„ - -	On board vessel	—	„

and discharge cargo. The immigrants were detained at the hospital site until they had furnished satisfactory addresses, a condition which all had complied with by August 31st. No further case of cholera occurred amongst them.

On August 26th the S.S. "Gerona" arrived at the Tees Port (Middlesbrough) from Hamburg with a crew of 33 hands and 2 passengers. She was at once boarded by the Port Medical Officer of Health, when all on board appeared to be well. She went into dock and most of the crew were paid off. The next day, August 27th, a seaman who had steered the vessel into dock became ill, and the Port Medical Officer of Health was immediately sent for. He ascertained the case to be one of cholera, and at once certified the vessel to be "infected," and ordered its removal to the Mooring Station; the cholera patient being too ill to be removed to hospital, was isolated on board the vessel, where he died the same evening. Attempts were at once made to ascertain the destination of such members of the crew as had been paid off, and where this was accomplished, the Sanitary Authorities of the districts concerned were duly informed.

On August 27th the S.S. "Talavera," on her arrival from Hamburg at Grimsby, was duly inspected by the Port Medical Officer of Health, when it was found that two of the crew exhibited symptoms of cholera. These men were removed to the floating hospital ship "Bradford" on August 28th, and the "Talavera" was taken to the Mooring Station to undergo cleansing and disinfection. Both patients recovered, but as will be noted at a later stage, further cases occurred on board this ship on August 30th and 31st respectively.

On August 27th one of the Lodging-house Inspectors of the Liverpool Corporation found a Russian emigrant suffering from diarrhœa, vomiting, &c. at No. 3, Great George Square, where a number of emigrants were staying, who had arrived at Liverpool on the previous day by rail from Hull, having come there from Hamburg on board the S.S. "Flamingo." The Inspector immediately informed the Medical Officer of Health, and as it was found that the symptoms were of a choleraic nature, the patient was removed without delay to the Urban Sanitary Authority's Hospital at Park Hill. About 10 o'clock the same evening another emigrant lodging at the same house was attacked with similar symptoms, and was at once removed to the Park Hill Hospital. On the same day another member of the same batch of emigrants, but staying at 75, Duke Street, was removed to the Brownlow Hill Hospital, in consequence of an attack of what was supposed to be simple diarrhœa. All three patients are said to have subsequently developed the true clinical symptoms of cholera, and the second of the two removed from Great George Square died on August 31st. The clothing and other effects belonging to the persons attacked were burnt, and the rooms which they had occupied were fumigated with sulphur and then cleansed. The baggage belonging to the whole party was thoroughly disinfected by the Urban Sanitary Authority's officials, as was also their personal clothing. Other cases occurred, however, on August 29th, and on September 5th amongst this batch of emigrants, and these will be referred to in due course.

On August 27th, also, a case of cholera was reported as having occurred in St. Pancras, in the person of a man who had arrived at Harwich from Rotterdam on August 24th on board the S.S. "Ipswich." On August 27th he was attacked with violent purging, vomiting, and cramps, and on August 29th was admitted to the Royal Free Hospital in Gray's Inn Road, where he eventually recovered. This man was a native of Prussia, and is stated to have been ill for 10 days before his admission

to the hospital. His alleged illness does not appear to have been such as to have called for action at the port of entry.

On August 29th cases of cholera were reported as having occurred at Liverpool and at Tynemouth respectively. The case at Liverpool was that of an emigrant living at 75, Duke Street, and was one of the same batch as those referred to as having been attacked on August 27th. This person developed choleraic symptoms, and was at once removed to the Urban Sanitary Authority's Hospital at Park Hill, and his effects burnt. The case proved fatal on September 1st. The person attacked at Tynemouth was one of the crew of the "Gerona" to which I have already referred as having had a case of cholera on board on August 27th, in the Tees port. The man in question had gone to North Shields in the Tynemouth district on August 27th, and since that day had been under the observation of the Local Authorities, in consequence of an intimation received from the River Tees Port Authority. He developed choleraic symptoms on August 29th, and was at once isolated in the Tynemouth Urban Sanitary Authority's Hospital, where he eventually recovered. No further cases occurred amongst the crew of the "Gerona."

On August 30th the occurrence of cases of cholera was reported in the Ports of London and Grimsby and in the Islington district of London. The cases in the Port of London, two in number, were found on board the "Hélène," a vessel which was towed into the port from Dover on that day. This vessel had arrived off Dover from Hamburg on August 27th, having left the latter port on Saturday, August 20th. On her arrival at Dover the vessel was inspected by the Medical Officer of Health. He found that of a crew of 10 men, three had suffered from illness suspicious of cholera on the voyage. The first man was attacked immediately after the vessel had left Hamburg on August 20th, the second on August 22nd, and the third on August 23rd. Two of the men were ill at the time of his visit. As the Dover Urban Sanitary Authority had made no special provision for the reception of cholera patients, the vessel was detained in Dover Bay, and medicines, &c. were supplied to the patients. On August 29th, as a result of representations made to the Medical Officer of Health by the German Consul at Dover to the effect that the "Hélène" was in a most dangerous position in consequence of the heavy sea and unsafe anchorage, permission to tow the vessel to Gravesend was granted by the Medical Officer of Health for Dover. Upon the arrival of the vessel at Gravesend in the Port of London, the two persons last attacked were found to be still suffering from cholera, and were at once removed to the Port Sanitary Authority's Hospital. One man recovered, and the other died from exhaustion following cholera on September 9th. The vessel was sent to the Mooring Station for thorough disinfection and cleansing, and no further cases occurred.

The subsequent history of this vessel is of some interest. It appears that she proceeded from London to Guaymas in Mexico, where she arrived on March 16th, 1893. The following note with respect to the "Hélène" appeared in the "Two Republics," a paper published in the city of Mexico:—"Guaymas, March 16th. The arrival of the barque "'Hélène' from Hamburg has caused intense excitement in this port. "She left Hamburg August 20th [1892], and arrived at Gravesend "August 29th with two cases of cholera in her crew.

"One of the sailors died, the other, who recovered, sailed in the "same vessel for this port September 3rd [1892]. After an uneventful

P. A. No. 12.
1 the Origin
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olera in 1892;
Dr. Barry.

" passage of 186 days the vessel anchored at the Isla de Pajores, in the " harbour, with cargo for the firm of Seldner and Von Boertel. As the " vessel was not thoroughly disinfected at Gravesend, England, the " Authorities have refused to let her discharge her cargo, and she will " go to Acapulco, the chief quarantine port on the Pacific coast."

What the Mexican authorities understand by "thorough disfection," or what danger could arise from a vessel upwards of half a year after the occurrence of the last of cholera on board, it is difficult to conceive.

At Grimsby a third member of the crew of the "Talavera" was attacked with cholera on August 30th, and was removed to the floating hospital on the same day. This man eventually recovered.

On August 30th the Medical Officer of Health for the Islington district of London reported to the Board that two persons who had come on board the S.S. "Peregrine" from Hamburg by way of Harwich on August 29th had been attacked with choleraic symptoms early on the morning of the 30th, at their house in the City Road, Islington. They, together with a third member of the family who had been travelling with them, were removed to St. Bartholomew's Hospital. The third person referred to proved not to have taken the infection, and was discharged from the hospital on the following day. The other two patients are stated to have exhibited undoubted symptoms of cholera, and one, a man aged 44 years, died on August 31st; the other, a child aged 3½ years, recovered. The "Peregrine," after discharging her passengers at Harwich on August 29th proceeded to London, where she was intercepted on August 30th by the officers of the Port Sanitary Authority and detained for thorough disinfection and cleansing. The linen, bedding, &c. from this vessel, which had been landed at Harwich without submission to any form of disinfection, was traced to a laundry at Colchester and thence to a warehouse in the Whitechapel district. Notice was immediately given to the Local Authorities, who promptly took the necessary steps to have these effects properly disinfected. No further cases of cholera are reported to have occurred in connexion with the "Peregrine."

On August 31st a further case of cholera developed on board the "Talavera" at Grimsby, and was removed to the floating hospital, where he eventually recovered, and no further cases were reported in connexion with this vessel.

On the same day the S.S. "Clement" arrived at Falmouth from Hamburg, which she had left on August 27th. On her arrival it was reported that several of her crew had been taken ill at Hamburg, and that two of them had been left there in hospital suffering from "cholerine." Upon medical inspection of the crew, the Port Medical Officer of Health found the second engineer and two of the crew suffering from choleraic diarrhœa, accompanied with vomiting and cramps. The vessel was at once sent to the Mooring Station, and the three men attacked were removed to the Port Cholera Hospital. All eventually recovered, and no further spread of the disease was reported.

On September 4th the S.S. "Elbe" arrived from Hamburg about 9.30 p.m. at the River Tyne Port, having on board a case of cholera in the person of the chief mate. The patient was removed to the River Tyne Port Sanitary Authority's Hospital in a state of collapse, and died before 6 o'clock next morning. The removal of the case was effected within half an hour after the vessel passed the Boarding Station. The remainder of the ship's company were in good health at the time of the mate's removal to the hospital, and no further suspicious cases are

reported to have occurred. The ship was disinfected, and the effects of the first mate were burnt. The captain of the "Elbe" stated that whilst the vessel was at Hamburg a sick man was taken from her to hospital, and in the ship's articles the Vice-Consul referred to this case as one of "cholerine." This man's effects were destroyed by the doctor's orders at Hamburg, and his berth was disinfected by the local authorities before the "Elbe" left that port.

On September 5th the S.S. "Oldham," on her arrival at Grimsby from Hamburg, was found to have a case of cholera on board in the person of a first-class passenger, who was at once removed to the Sanitary Authority's floating hospital. The rest of the passengers, fourteen in number, who showed no signs of illness, were allowed to proceed to their destinations, after furnishing their addresses. The vessel was sent to the Mooring Station for disinfection, and a deck cargo of fish was destroyed. The patient landed from this vessel died on September 11th. No further cases were reported to have occurred amongst either passengers or crew.

On September 5th, also, a man living at 3, Great George Square, Liverpool (a fifth member of the party of emigrants already referred to as having travelled viâ Hull to Liverpool on August 26th), complained of pains in the abdomen and vomiting, which he attributed to some food he had eaten. On the morning, however, of September 6th the case was notified by the doctor in attendance to the Health Department, and the patient was immediately removed to the Urban Sanitary Authority's Hospital at Park Hill as a suspected case of cholera. This person, whose clinical symptoms were never very characteristic of cholera, recovered, but from a bacteriological examination of the evacuations made on September 7th, the case was found to be indistinguishable from Asiatic cholera. No further cases of cholera were reported from Liverpool in 1892.

On September 6th, upon the arrival of the S.S. "Ashington" from Hamburg at the River Blyth Port at 1 a.m., the steward was found to be suffering from what the Medical Officer of Health diagnosed as a mild form of cholera. He was at once removed to the South Blyth Urban Sanitary Authority's Hospital, where in the end he recovered. The vessel was sent to the Mooring Station for disinfection. The crew were at once allowed to land on furnishing their correct addresses, and no other cases occurred among them.

On September 15th the schooner "Elizabeth Alice" arrived at the Port of London from Hamburg viâ Antwerp with a man ill on board. From the history of the case and the symptoms, coupled with the fact that the vessel had come from infected ports, Dr. Collingridge was of opinion that the man was recovering from an attack of cholera. As he was almost convalescent, it was decided not to remove him to a hospital. The vessel was subsequently disinfected, and no further cases were reported.

On September 15th, also, the "Titania" arrived at the Port of London from Antwerp with the mate ill. On examination by the Port Medical Officer of Health, he was found to be suffering from cholera and the vessel was sent to the Mooring Station. On the 16th, as the patient was convalescing, it was decided not to remove him to hospital, and on September 20th, after thorough fumigation and cleansing of the vessel had been carried out, the bilge pumped out, and the water casks emptied, the vessel was allowed to proceed, and no further cases occurred.

On September 18th, at 11 p.m., the S.S. "Uranus" arrived at the Port of Hull from Hamburg, with a crew of 12 hands. The vessel was medically inspected in the river at 12.45 a.m. on September 19th. The crew being then apparently all well, the vessel proceeded in due course to the Humber Dock. About 9 a.m. it was reported to the master that one of the firemen was suffering from sickness and diarrhœa. The Custom House officials upon visiting the vessel notified the occurrence of this case to the Port Sanitary Authority, whereupon the Medical Officer of Health went on board and found the man to be suffering from cholera. In consequence he at once ordered the immediate suspension of all work and the isolation of the vessel. The patient was forthwith removed in an ambulance to the Port Sanitary Authority's Hospital, where he died the following day. About 4 p.m., the "Uranus" was taken to the Mooring Station in order to undergo the necessary disinfection and cleansing, and no further cases were reported.

On September 19th, upon the arrival of the S.S. "Adelaide" from Rotterdam, a stoker was found to have developed choleraic symptoms. He was removed to the Harwich Port Hospital, where he recovered. No further cases were reported.

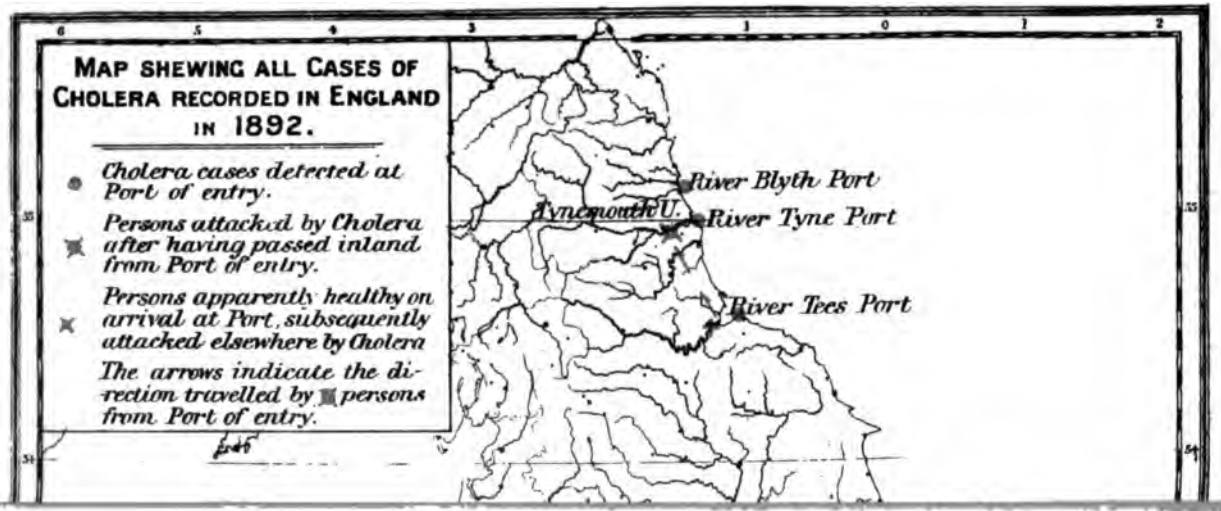
On September 24th a seaman, who was travelling by rail from Sutton Bridge to Plymouth, was suddenly seized, when the train was about ten minutes' run from Bridgwater, with violent abdominal pains, severe cramps in the arms and legs, followed by uncontrollable vomiting and diarrhœa. At Bridgwater he was lifted out of the train, taken to the lavatory, and afterwards carried to the Bridgwater Infirmary. He was accompanied there by a medical man who happened to be travelling in the same compartment with him, and who had regarded the symptoms as very suspicious of cholera. From the subsequent history of the case, there seems little doubt but that it was one of cholera. Upon inquiring into the antecedents of this man, it appeared that he had formed one of the crew of the S.S. "Glenavon," which had arrived at Sutton Bridge, in the Port of Wisbech, on September 24th, from Solombola, near Archangel, in Russia. The crew of this vessel consisted of 15 hands all told. The cargo (timber) was taken in at Solombola, which port was left on September 9th, the only port touched at on the passage being Bergen. The patient subsequently recovered. He stated that water for the voyage for drinking and other purposes was taken in at Solombola from the River Dwina, at a point about seven miles below Archangel, where he alleged that cases of cholera had occurred.* He further stated that there had been two cases of diarrhœa on board the vessel during her voyage, the two persons affected being a sailor and a fireman, who were both taken ill four or five days after leaving Solombola. The sailor was ill for two days with diarrhœa, sickness, and cramps, and the fireman for nearly a week with the same symptoms. The patient further stated that neither of these men had been confined to their bunks, and that they attributed their illness to the water supply.

On September 24th the S.S. "Esperanza" (crew of 19 hands), from Hamburg, arrived at Hull at 8.30 a.m. She was medically inspected at 8.45 a.m., and all on board were apparently well; but between 9 and 10 a.m., after the arrival of the vessel in dock, the

* Subsequent communication with Her Majesty's Consul at Archangel elicited the facts that Solombola is only some four miles from Archangel; and that the Russian authorities at Archangel denied the existence of any cases of cholera there, but that they had recommended that the water of the River Dwina should not be used for drinking purposes.

CHOLERA IN ENGLAND 1892.

Map XVII.


MAP SHEWING ALL CASES OF CHOLERA RECORDED IN ENGLAND IN 1892.
Cholera cases detected at Port of entry.
Persons attacked by Cholera after having passed inland from Port of entry.
Persons apparently healthy on arrival at Port, subsequently attacked elsewhere by Cholera
The arrows indicate the direction travelled by persons from Port of entry.
River Blyth Port
Tynemouth U.
River Tyne Port
River Tees Port

master was suddenly attacked with symptoms of cholera. This occurrence was at once notified to the Port Medical Officer of Health, and the patient was removed to the Port Sanitary Authority's Hospital, where he eventually recovered. All communication with the "Esperanza" was stopped, and on the first tide she was sent to the Mooring Station for disinfection and cleansing. No further cases were reported.

On October 3rd the S.S. "Ben Alder" arrived at the Port of London from Hamburg. Upon medical inspection it was ascertained that two men had been ill on the voyage; one had had slight diarrhœa, but was apparently well again; the other, who had been attacked on October 1st with choleraic symptoms, was convalescing, and was consequently allowed to remain on the vessel. The "Ben Alder" was sent to the Mooring Station for the necessary disinfection, cleansing, &c., and whilst there another seaman developed symptoms of cholera. He was at once removed to the Port Sanitary Authority's Hospital, where he recovered. No further cases were reported.

On October 18th the S.S. "Biafra" arrived at the Port of London from Hamburg. The master stated on oath that all on board were well. Upon medical inspection of the crew being made, however, it was found that a negro was suffering from acute diarrhœa with collapse. The disease was regarded as cholera by the Port Medical Officer of Health, and the patient was at once removed to the Port Sanitary Authority's Hospital, where he subsequently recovered. The "Biafra" was sent to the Mooring Station for disinfection.

On October 21st the S.S. "Hamburg" arrived at the Port of London from Hamburg, which she had left on October 18th at 11.30 p.m. On the following day, the 19th, a fireman was attacked by cholera; he was, however, convalescent on arrival, and was not removed to the hospital. The vessel was disinfected, and was then allowed to go on to her destination.

The topographical situation of the ports at which cases of cholera were detected in 1892 is indicated in the annexed Map XVII.

In addition to the vessels named above, which were reported to have actually had cholera cases on board on their arrival, a number of vessels reached the ports of this country on which cases of cholera had occurred on the voyage. The following may be taken as an example of this class of infected vessel. The S.S. "Holdernesse" (18 hands), sailed from Grimsby on Tuesday, August 16th, at 2 a.m. Arrived at Cronstadt at 7 a.m. on Thursday, August 25th; discharged cargo and left Cronstadt for St. Petersburg at 6 a.m. on September 2nd, arriving at that port at 11 a.m. Completed cargo and left St. Petersburg on Wednesday, September 7th, at 6 a.m. The ship on leaving Grimsby took in water, and on arriving at St. Petersburg took in a fresh supply from the River Neva. On Wednesday, September 7th, whilst on watch, a fireman sickened with diarrhœa and cramps (rice-water stools). He somewhat recovered, and was on duty on September 11th, but was again suddenly seized with illness whilst on duty, and died at 4.30 a.m. on Monday, September 12th. He was buried at sea on the same day at 7 p.m. A second fireman sickened about 4 a.m., on Monday, September 12th, with diarrhœa and cramps (rice-water stools), and died after receiving every attention about 11.30 a.m., on Tuesday, September 13th. He was buried at sea at 5.30 p.m. on the same day. The master, on arriving at Spurn Point, about 7 p.m. on September 13th, took in a pilot, and reported the facts as above, afterwards proceeded to the port of Hull, arriving at the Boarding Station at about 10 p.m. The vessel was boarded by H.M. Customs and the Acting Medical Officer of Health. After due

investigation the vessel was ordered to the Mooring Station, in accordance with the Cholera Regulations. There were no passengers on board, and as the crew were necessary to navigate the vessel, they proceeded with her to the Mooring Station whilst the necessary disinfection was being carried out. The crew ultimately landed, their names and addresses having been taken. A fresh supply of good water was provided, the bilges were disinfected and pumped out, and after undergoing thorough disinfection the vessel was allowed to enter the dock.

Holland.

On August 26th, a person who had come by steamer from Altona was attacked by cholera on his arrival at Rotterdam, and died there. Upon the same date the S.S. "Jason" proceeding from Hamburg to Cologne, was detained in quarantine at Maasluis near Rotterdam, as she was found to have six cases of cholera on board. On August 28th, a Russian traveller who had left Hamburg with his family on August 25th sickened with cholera at S'Gravenhage (The Hague). The places named above are all situate in the Province of Zuidholland.

On August 30th, a man recently arrived from Hamburg died of cholera at Groningen the principal town in the province of that name, which is situate at the north-eastern extremity of the kingdom.

In the first week of September a death from cholera was recorded at Velzen in the Province of Noordholland, and shortly afterwards the presence of the disease was notified at Amsterdam in the same province.

On September 15th, a rag-dealer living at Meerssen in the Province of Limburg died from cholera, and on the same date a death from the disease was registered at Heusden in the Province of Noordbrabant.

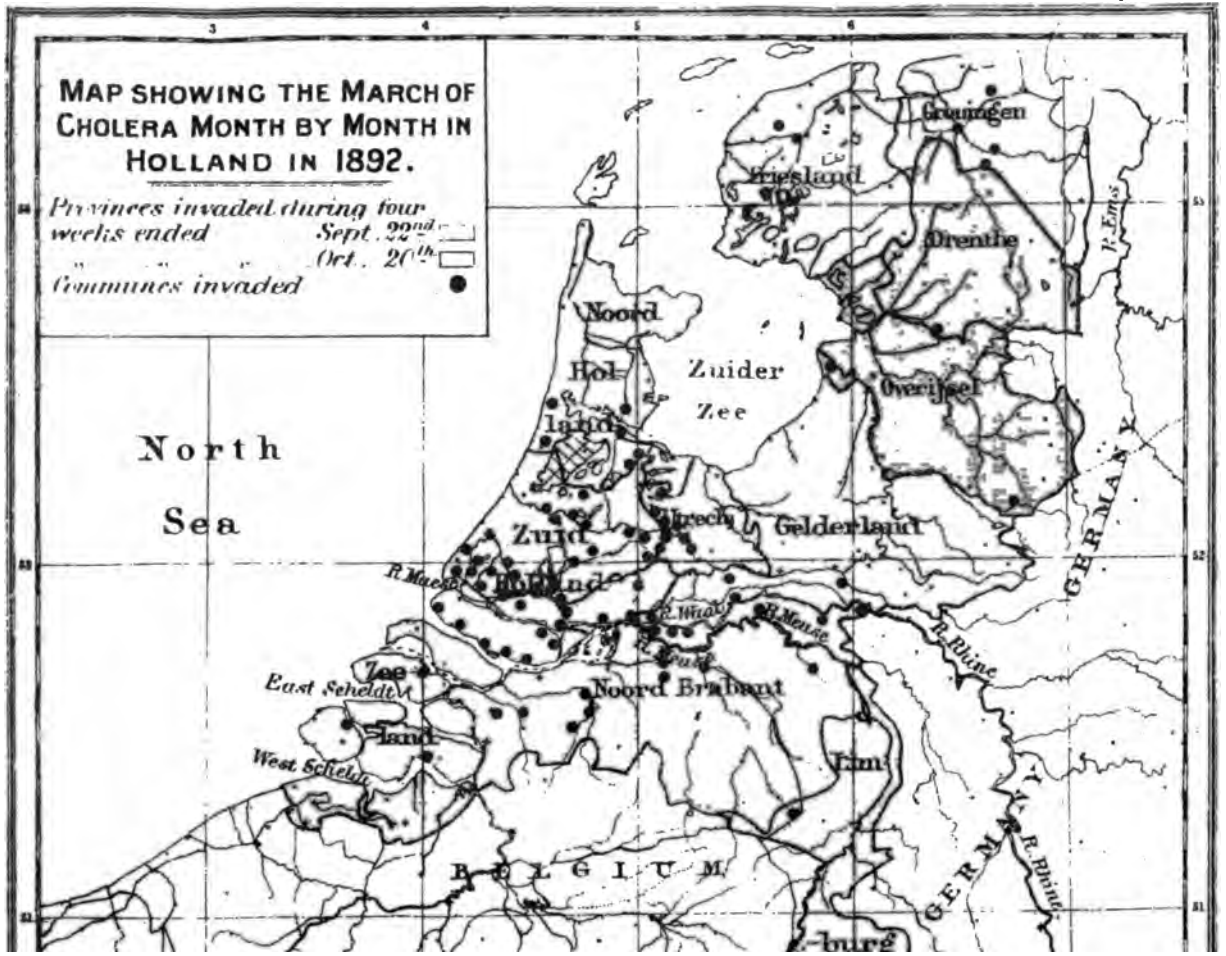
On September 17th, a fatal case of cholera occurred at Maarssen, in the Province of Utrecht, and a day or two afterwards, cases were recorded at Breukelen, Nijenrode, and at Utrecht in the same province.

On September 18th, a fisherman from Rotterdam was attacked by cholera at Millingen, in the Province of Gelderland; and on the same day a soldier was seized by the disease at Berlicum in the Province of Friesland. On the following day (September 19th) a case occurred at Veere in the Province of Zeeland.

Thus within four weeks from the notification of the first case at Rotterdam, the disease had invaded nine of the eleven provinces of Holland. The two remaining Provinces, Overijssel and Drenthe, were reported to have been invaded on the 2nd and 5th of October respectively. The diffusion of cholera according to time is illustrated in Map XVIII.

Of the cases of cholera which occurred during the first half of September, the great majority are stated to have arisen amongst persons either coming from Hamburg, or who from the nature of their avocations (boatmen, sailors, dock-labourers, &c.) had to do with shipping. In addition to the importation of cholera from Hamburg, at least one case occurred on board a vessel coming from Antwerp, bound for Dordrecht.

Upon the introduction of cholera into Holland, it spread rapidly over a very wide area, and it was especially observed that this spread followed the lines of rivers and canals, upon which the greatest traffic from infected places was carried on, and an especial incidence was observed to take place on young persons employed on ships navigating the rivers Maas and Vecht, and consequently on September 21st an official warning


MAP SHOWING THE MARCH OF CHOLERA MONTH BY MONTH IN HOLLAND IN 1892.
Provinces invaded during four weeks ended Sept. 22nd
Oct. 20th
Communes invaded
North Sea
Groningen
Friesland
Drenthe
Noord Holland
Zuider Zee
Overijsel
Zuid Holland
Utrecht
Gelderland
Zeeland
Noord Brabant
Limburg
BELGIUM
GERMANY
R. Maese
R. Waal
R. Rhine
East Scheldt
West Scheldt

Map XIX.

163. Carter Lane 5406·12·93

was issued against the use of the waters of these rivers for drinking purposes.

From August 26th to December 31st, fatal* cases of cholera occurred in 88 communes throughout Holland, of which 10 were situate in the Province of Noordbrabant, 10 in Gelderland, 40 in Zuidholland, 6 in Noordholland, 3 in Zeeland, 8 in Utrecht, 4 in Friesland, 2 in Overijssel, 3 in Groningen, and one each in Drenthe and in Lemburg. Notwithstanding this widespread diffusion of cholera in the kingdom, the actual number of deaths was comparatively small in the whole country amounting only to 293, a number equivalent to a rate of ·6 per 10,000 of the population, whilst in only four towns did the number of fatal cases reach or exceed ten, these towns being Utrecht with 35, Rotterdam with 22, IJsselstein with 17, and Amsterdam with 10 deaths.

In the following Table XXXV. is given the number of deaths from cholera recorded in the several Provinces of Holland from the commencement of the epidemic to December 31st, 1892, together with the mortality rates per 10,000 of the population.

TABLE XXXV.

Provinces.	Date of first recorded case of Cholera.	Population.	Deaths from Cholera.	
			Number.	Rate per 10,000 of the Population.
Zuidholland - -	Aug. 26 -	987,342	134	*1·4*
Groningen - - -	„ 30 -	277,282	6	*0·2*
Noordholland - -	Sept. 7 -	860,742	20	*0·2*
Limburg - - -	„ 15 -	259,593	1	*0·04*
Noordbrabant - -	„ 15 -	516,670	24	*0·5*
Utrecht - - -	„ 17 -	226,847	79	*3·5*
Gelderland - - -	„ 18 -	520,210	17	*0·3*
Friesland - - -	„ 18 -	336,442	5	*0·15*
Zeeland - - -	„ 19 -	202,096	3	*0·15*
Overijssel - - -	Oct. 2 -	300,493	3	*0·1*
Drenthe - - -	„ 5 -	134,027	1	*0·07*
Holland - -	—	**4,621,744**	**293**	**0·6**

From the above Table it will be seen that the mortality from cholera in Holland during 1892 was ·6 per 10,000 of the population, and that upwards of two-thirds of the total deaths occurred in the Provinces of Utrecht and Zuidholland where the rates of cholera mortality were 3·5, and 1·5 per 10,000 respectively, and it was only in these provinces that the rate for the kingdom was exceeded. The number of deaths from cholera recorded in each commune of the several provinces of Holland is given in Table E. annexed to this report. The topographical position of the communes invaded by the disease during 1892 is shown in Map XVIII. and the relative mortality from cholera in the several provinces in Map XIX.

* As no official report on cholera in Holland during 1892 has been published to the date of writing it is not possible to give reliable figures with respect to non-fatal cholera.

Denmark.

On August 29th, a case of cholera was reported at Aarhus in the province of Jutland, in the person of a man who two days previously had returned from Hamburg, where he had passed a night. He died the following day, and, on August 30th, a second case occurred, that of a man who had attended to the corpse of the first case, and had acted as bearer at his funeral. This man also died. In both these cases Professor Salomonsen made a bacteriological examination and confirmed the presence of Asiatic cholera.

On August 31st, at Fredericia a young man who had just returned from Hamburg was attacked by cholera, but speedily recovered. On September 3rd, a medical student who was engaged at Professor Salomonsen's laboratory at Copenhagen, in the examination of the choleraic material from the cases at Aarhus, was seized with cholera, from which he recovered.

Beyond these four cases, cholera appears not to have spread in Denmark.

Morocco.

On August 31st a steamer arrived at Tangiers with several persons on board suffering from cholera, and of these two died.

No further cases of cholera were reported to have occurred in Morocco in 1892.

Italy.

On September 2nd* a lady arriving from Hamburg at Capri died of cholera, and on the 9th of the same month her servant, who had accompanied her, died of the same disease.

No further cases of cholera were reported to have occurred in Italy in 1892.

Norway.

Two cases (both fatal) of cholera were reported to have occurred in Norway during the year. Both these cases were reported by Her Majesty's Consul-General at Christiania. The first case was that of a seaman attacked at Christiansund on September 4th, two days after his arrival in a vessel from Hamburg. He died on September 6th. The second case also occurred at Christiansund on September 24th, and was that of a person on board the Norwegian S.S. "Jarl," which had arrived from Dordrecht. This case also proved fatal.

Austro-Hungarian Empire.

The sanitary administrations of Austria and Hungary being quite distinct, I propose to deal with the progress of cholera in each separately, commencing with Austria, as it appeared in that portion of the Empire first in point of time.

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* Despatch from Her Majesty's Ambassador at Rome.

(*a.*)—*Austria.*

According to the official report* upon cholera in Austria, it appears that the presence of that disease in Russia and in Germany was a source of grave anxiety to the sanitary administration of the Empire, for former experience had rendered it certain that when cholera once became established in Germany, its introduction into Austria was merely a matter of time. Accordingly strenuous efforts were made, not only to secure an organised system of inspection on the frontiers of the Empire, but by the carrying out of sanitary measures to prepare the country to resist the spread of the disease if once introduced. Later the danger of the importation of cholera was much increased when it became prevalent in Hungary.

The first case of cholera in the Austrian portion of the Empire occurred on September 8th in the town of Podgorze, in the department (Politische Bezirke) of Wieliczka, in the province of Galicia. Further cases occurred in the same town on the 9th, 11th, 12th, and 13th of the same month. On September 11th occurred the first case of cholera recorded in the town of Krakau, a town of which Podgorze may be regarded as a suburb, and from which it is separated by the River Weichsel. This case was that of a person living in the Kazimierz quarter, a part of the town which lies close to the Weichsel, immediately opposite to Podgorze. Within the next few days further cases of choleraic sickness occurred in Krakau.

The first cases were not recognised as being due to cholera, as neither the clinical symptoms nor the results of the post-mortem examinations were such as to point conclusively to that disease, and it was not until a bacteriological investigation had been made by Dr. Krokiewicz (the Medical Officer for the department) in the Government laboratory at Lemburg, that the disease was found to be indistinguishable from cholera. The results obtained by Dr. Krokiewicz were confirmed by Dr. Weichselbarnim, the professor of bacteriology in the University of Vienna, who was despatched to Krakau by Government to inquire into the matter.

How and whence the disease was introduced into Podgorze is unknown, though every attempt was made by the authorities to trace it. It is supposed to to have been brought into the district by workmen returning to their homes from either Russia or Hamburg. It appears probable that a number of cases had occurred in the Lazarus hospital at Krakau before the case at Podgorze was observed. For three weeks after the confirmation of the first case, the epidemic in this neighbourhood was limited to the two towns of Podgorze and Krakau.

On September 12th, an independent importation of cholera took place in Wolowice in the department of Gorlice, situate near the Austria-Hungarian boundary. A woman returning from America to her home at Wolowice, landed at Hamburg on September 3rd, and after being subjected to medical supervision in that place for five days, finally reached her home on September 11th, and was attacked by cholera on September 12th. With this case three further cases in the same town were connected, after which no further spread took place in the neighbourhood.

In the beginning of October, when cholera had become established in Podgorze and Krakau, the disease spread in quick succession to a number of other towns and villages in the departments of Krakau and Wieliczka. The following Table XXXVI. gives a list of these places, with the date of attack in each :—

* See footnote ‡, page 117, *ante*.

TABLE XXXVI.

Date of First Case of Cholera.	Name of Parish.	Name of Department.
October 1st	Koscielniki	Krakau.
„ 2nd	Zwierzyniec	„
„ 2nd	Debniki	Wieliczka.
„ 2nd	Plaszow	„
„ 3rd	Niepolmice	Bochnia.
„ 5th	Lusina	Wieliczka.
„ 6th	Ludwinow	„
„ 6th	Dabie	Krakau.
„ 8th	Ujazd	„
„ 12th	Tyniec	Wieliczka.
„ 12th	Piaski-wielkie	„
„ 17th	Grzegorski	Krakau.
„ 18th	Russocice	„
„ 25th	Prokocim	Wieliczka.
„ 26th	Dobczyce	„
„ 31st	Rzaka	„

With the exception of Koscielniki and Ujazd, both of which are situate close to the Russian frontier, all the places in the table above lie in close proximity to either Podgorze and Krakau or to the River Weichsel. The towns of Luzina, Dobczyce, Piaski-wielkie, Prokocim, and Rzaka are all situate near Krakau-Podgorze, whilst the towns of Zwierzyniec, Debniki, Tyniec, and Russocice lie above, and Grzegorski, Plaszow, Dabie, together with the villages of Pasternik and Mszezin in the parish of Niepolomice, lie below Krakau on the River Weichsel. In all these cases the disease is believed to have spread from Krakau or from Podgorze. As regards Koscielniki and Ujazd, cholera was probably introduced directly from Russia.

On November 2nd, an isolated case of cholera occurred at Zachwiejow in the department of Mielec, where a raftsman, who had already been suffering from diarrhœa in Russia, died. In like manner another raftsman, who had also just returned from Russia, was attacked by and died from cholera at Dabrowka in the Department of Nisko on November 4th. Both cases remained isolated.

In the month of November cholera appeared to have died out everywhere in Galicia, when a sudden outbreak of the disease was reported to have taken place in the department of Husiatyn, close to the Russian frontier of East Galicia, which is here formed by the River Zbrucz. The first case occurred on November 14th in the town of Husiatyn. The disease spread to other towns lying near the river in the Department of Husiatyn, and later to towns also situate on the Zbrucz in the adjoining department of Borszczow, which lies to the south of of the Husiatyn.

The following Table XXXVII. gives a list of these places with the date of the first recorded case of cholera in each:—

SAXONY
BAVARIA
MOLDAVIA
ITALY
SWITZERLAND
Salzburg
Innsbruck
Trieste
Czernowitz
Departments and Counties invaded
by Cholera during
Four weeks ended Oct. 5th
" " " Nov. 2nd
" " " Nov. 30th

TABLE XXXVII.

Date of First Case of Cholera.	Name of Parish.	Name of Department.
November 14th	Husiatyn	Husiatyn.
„ 15th	Olchowczyk	„
„ 20th	Szydlowce	„
„ 23rd	Suchodol (Bednarowka)	„
December 3rd	Czarnokonce wielkie	„
„ 7th	Kociubinczyki	„
„ 22nd	Zalucze	Borszczow.
„ 23rd	Wierzbowka	„
„ 23rd	Siekierczynce	Husiatyn.
„ 24th	Zielona	„
„ 25th	Sidorow	„

From Map XX. it will be observed that all these places are situate close to the Russian frontier. The town of Husiatyn is divided by the River Zbrucz from the Russian town of the same name, with which it is connected by a bridge. From the above table it will be seen that cholera appeared almost simultaneously in Husiatyn and in Olchowczyk, a town lying immediately to the north of it, and shortly afterwards its presence was confirmed in Szydlowce and Suchodol, both of which places lie to the south of Husiatyn. The disease continued to spread southwards, attacking the various places in the order shown in the table.

All the cholera infected districts in Table XXXVII. with the exception of Czarnokonce lie close to the River Zbrucz, which here winds about greatly, in some cases surrounding the places on three sides. The river finally joins the Dniester shortly after passing out of Galicia. There can be little question that the disease was directly introduced into Eastern Galicia from Russia, special facilities existing for intercourse between the two districts at the time when the invasion took place, due to the fact that the river was at the time frozen over.

In the Province of Galicia cases of Asiatic cholera were confirmed during 1892 in the town of Krakau, and in 31 towns or villages situate in eight departments. In these towns and villages 207 cases of cholera was notified, and of these 119 terminated fatally. These figures give an attack-rate and a death-rate of 2·7 and 1·6 per 10,000 of the population of the Province respectively. The number of cases and deaths reported in each parish is given in Table E. (1) appended to this report, and from this it will be observed that the prevalence of cholera was greatest in proportion to the inhabitants in Piaski-wielkie Zalucze and Szydlowce, where the attack rates were 257, 199, and 158 per 10,000 of the population respectively. In no other places did the disease acquire epidemic proportions. It is stated that in no instance did any spread of cholera take place from Galicia to any other part of the Empire or to any of the adjoining foreign states.

In the Province of Bohemia one case of cholera was imported to Wrabsko near Pisek on October 15th, in the person of a mason returning from Hungary, but here no further spread took place. In like manner a case was imported by a raftsman returning to Sabofzen near Pettau in the Province of Steiermark, but here the disease did not spread beyond his own family. In Vienna four cases only of cholera were confirmed in October, all traced to Hungary. From none of these did any further cases arise. The total number of cases of cholera in the Austrian portion of the empire in 1892 amounted to 214, of which 125 proved fatal. Of these cases 207 attacks, with 119 deaths, occurred

in Galicia, 4 attacks, 3 deaths in Lower Austria, 2 fatal attacks in Steiermark, and one fatal attack in Bohemia.

The number of cases and of deaths from cholera recorded as having occurred in each Department of Austria, together with the population of the Departments, are given in Table XXXVIII.

TABLE XXXVII.

STATISTICS of CHOLERA in the SEVERAL DEPARTMENTS (Politische Bezirke) of AUSTRIA during 1892.

Province.	Department (Politische Bezirke).	Date of First Recorded Case of Cholera, 1892.	Places Invaded.	Population (Census 1890).	Number of Recorded Cholera		Rate per 10,000 Population, Cholera		Deaths per cent. of Recorded Attacks, "Fatality."
					Cases.	Deaths.	Cases.	Deaths.	
Galizien - -	Wieliczka -	Sept. 8	10	104,722	82	49	7·8	4·9	59·9
„ - -	Krakau (City)	„ 11	1	74,593	42	23	5·6	3·1	54·8
„ - -	Gorlice - -	„ 12	1	79,670	4	2	0·5	0·25	50·0
„ - -	Krakau (District).	Oct. 1	6	73,381	10	8	1·4	1·1	80·0
„ - -	Bochnia -	„ 3	1	101,103	9	4	0·9	0·4	44·5
Böhmen - -	Pisek - -	„ 15	1	75,707	1	1	[0·1]	[0·1]	—
Steiermark -	Pettau - -	„ ?	1	79,150	2	2	0·2	0·2	—
Nieder Oesterreich.	Wien (City) -	„ ?	1	1,364,548	4	3	0·03	0·02	—
Galizien - -	Mielec - -	Nov. 2	1	71,296	1	1	[0·1]	[0·1]	—
„ - -	Nisko - -	„ 4	1	60,270	1	1	[0·2]	[0·2]	—
„ - -	Husiatyn -	„ 14	0	89,377	43	23	4·8	2·5	51·2
„ - -	Borszczow -	Dec. 22	2	106,755	15	9	1·4	0·8	60·0
Totals -	- - -	- -	35	2,280,577	207	119	0·9	0·5	57·5

(*b.*) *Hungary.*

From the official records* it appears that special measures for combating cholera were taken in the Hungarian portion of the Empire early in July on similar lines to those already referred to as having been adopted in the Austrian portion of the Empire. On the appearance of cholera in Galicia early in September further steps were taken. For the defence of the frontiers forty-eight stations in all were established upon the Galician, Bukovinian and Roumanian frontiers, through which all persons entering Hungary had to pass, and where they submitted to medical examination. Towards the end of September several persons were attacked at Budapest with symptoms suspicious of cholera, but it was not until September 26th that the bacteriological examinations (which had been made in every instance) confirmed the existence of cholera in a case which occurred on that date. Between September 28th and 30th eleven more cases of cholera were recorded at Budapest, and from the last-named date onward, cases occurred in increasing numbers until October 6th, on which day forty-five persons were reported to have been attacked by the disease in that city. The earliest cases are said to have occurred amongst workmen engaged in unloading hides from Hamburg.

Between September 26th and October 5th cases of cholera were reported from several towns and villages lying on the Danube and situate in the counties of Fejér, of Pest-Pilis-Solt-Kis-Kun, and of Tolna, which are all below Budapest.

In the course of the four weeks October 6th—November 2nd, considerable extension of the disease took place in Hungary In the first instance it spread down the Danube to its junction with the River Theiss (Tisza) and invaded towns and villages situate in the

* *See* footnote **, page 117, *ante*.

counties of Baranya, Bács-Bodrog and Torontál. On reaching the Theiss cholera spread up that river and its navigable tributaries the Bega, the Maros, and the Körös, affecting towns and villages in the counties of Bács-Bodrog, Torontál, Temes, Csongrád, Arad, Békés and Jász-Nagy-Kun-Szolnok situate on one or other of the above-named rivers. In the meantime a further extension of the disease took place up the Danube to the counties of Esztergom, Komáron, Györ, Hont, Sopron and Pozsony.

From Map XX. in which the march of cholera in Austro-Hungary is illustrated, it will be observed that with very few exceptions the towns and villages attacked by cholera in 1892 in Hungary were situate on the rivers named above, the only notable exceptions to be observed being places situate in the mountainous counties of Liptó, Turócz, and Trencsén to which the first cases are reported to have been introduced by workmen returning to their homes from Budapest.

In Tables XXXIX. and XL. the statistics, of cholera in the several counties (vármegyék) and municipal towns (városok) of Hungary during 1892 are given.

TABLE XXXIX.

STATISTICS of the CHOLERA EPIDEMIC in the several COUNTIES (VARMEGYÉK) of HUNGARY from its commencement to December 31st, 1892.

Name of County.	Population.	Number of Communes invaded by Cholera.	Total recorded Cholera.		Rates per 10,000 of the Population.		Per-centage of Deaths to Attacks "Fatality."
			Attacks.	Deaths.	Attacks.	Deaths.	
Arad	301,545	1	11	7	0·4	0·2	63·6
Bács-Brodrog	573,114	17	153	103	2·7	1·8	67·4
Baranya	298,218	3	41	22	1·4	0·8	53·6
Bars	152,910	2	6	4	0·4	0·3	66·6
Békés	258,386	2	3	3	0·1	0·1	—
Csongrád	164,340	5	13	8	0·8	0·5	61·6
Esztergom	78,378	11	90	36	11·5	4·6	40·0
Fejér	194,907	12	92	48	4·7	2·5	52·2
Györ	92,992	2	10	4	1·1	0·4	40·0
Hont	107,743	1	8	5	0·7	0·5	62·5
Jász-Nagy-Kun-Szolnok	318,475	10	48	26	1·5	0·8	54·2
Krassó-Szorémy	407,635	2	3	3	0·07	0·07	—
Komáron	146,428	2	23	10	1·6	0·7	43·5
Liptó	76,850	11	44	23	5·7	3·0	52·3
Pest-Pilis-Solt-Kis-Kun	684,298	28	151	100	2·2	1·5	66·3
Pozsony	278,959	3	7	5	0·3	0·2	71·5
Sopron	232,389	5	38	19	1·6	0·8	50·0
Temes	375,296	5	8	7	0·2	0·2	87·5
Tolna	252,098	8	34	23	1·3	0·9	67·6
Torontál	570,802	28	458	252	8·0	4·4	55·0
Trencsén	258,769	3	18	13	0·7	0·5	72·2
Turócz	49,979	1	1	1	[0·2]	[0·2]	—
Veszprém	215,280	2	6	6	0·3	0·3	—
Zemplén	299,497	1	1	1	[0·03]	[0·03]	—
Zolyom	112,413	1	6	4	0·5	0·4	66·6
Total	6,491,701	166	1,273	733	1·96	1·12	57·5

Table XL.

Statistics of Cholera recorded in the several Municipal Towns (Városok) invaded by that Disease during 1892.

Name of Municipal Town.	Population.	Total recorded Cholera		Rates per 10,000 of the Population.		Per-centage of Deaths to Attacks "Fatality."
		Attacks.	Deaths.	Attacks.	Deaths.	
Arad - - -	42,052	2	1	0·5	[0·2]	50·0
Baja - - -	19,485	7	6	3·7	3·1	85·7
Budapest - -	491,938	889	499	18·1	10·1	56·1
Panscova - -	17,948	1	1	[0·6]	[0·6]	—
Selmeczbánya -	15,280	1	1	[0·7]	[0·7]	—
Pozsony - -	52,411	3	2	0·6	0·4	—
Szeged - -	85,569	38	28	4·4	3·3	73·7
Temsevár - -	39,884	8	3	2·0	0·7	37·5
Ujvidék - -	24,717	8	6	3·2	2·4	75·0
Zombor - -	26,435	1	1	[0·4]	[0·4]	—
Totals of 10 Municipal Towns.	815,719	958	548	11·7	6·7	57·2

From the above tables it will be seen that in 1892, 166 towns and villages situate in 25 counties, and ten municipal towns were invaded by cholera, that the total number of attacks was 2,231, and that of these 1,281 were fatal. These figures are equivalent to an attack-rate of 3·0 and a death-rate of 1·75 per 10,000 of the population living in the invaded counties and towns. Of the 25 counties invaded during 1892 upwards of half the total deaths (733) recorded took place in the three counties of Torontál (252) Bács-Brodrog (103) and Pest-Pilis-Solt-Kis-Kun (100), where the rates of cholera mortality were 4·4, 1·8, and 1·5 per 10,000 of the population respectively. Exceptionally high mortality from cholera as compared with the mean rate for the invaded districts were also recorded in the counties of Esztergom (4·6) Liptó (3·2) and Fejér (2·5). Of the ten municipal towns Budapest only suffered from any serious outbreak of cholera. Here between September 26th and December 31st, 889 attacks, of which 499 proved fatal, were recorded, these figures being equivalent to an attack-rate of 18·1 and a death-rate of 10·1 per 10,000 of the population. In the following Table XLI., the daily record of cholera attacks and deaths in Budapest is given, and from this it will be seen that the maximum both of daily and weekly attacks occurred in the second week after the introduction of the disease into the city, when 201 attacks were recorded; and that after the second week the number of cases gradually declined, reaching the minimum at the end of December. Cases of cholera, however, continued to occur at Budapest until the first week of February 1893, the last case being recorded on February 6th. The total number of cases recorded at Budapest from September 26th, 1892, to February 8th, 1893, was 935, of which 525 proved fatal.

Table XLI.

Daily Record of Cholera Cases and Deaths during 1892 at Budapest.

Day of Month.	Number of Cholera		Week ending	Number of Cholera		Day of Month.	Number of Cholera		Week ending	Number of Cholera	
	Cases.	Deaths.		Cases	Deaths.		Cases.	Deaths.		Cases.	Deaths.
Sept. 26	1	—				Nov. 14	8	1			
„ 27	—	—				„ 15	1	3			
„ 28	3	1				„ 16	4	1			
„ 29	5	3	Oct. 2	37	19	„ 17	10	7	Nov. 20	34	20
„ 30	3	2				„ 18	5	2			
Oct. 1	12	1				„ 19	3	5			
„ 2	13	12				„ 20	3	1			
„ 3	19	8				„ 21	4	4			
„ 4	24	8				„ 22	3	2			
„ 5	33	18				„ 23	1	—			
„ 6	45	21	„ 13	201	99	„ 24	2	1	„ 27	15	10
„ 7	25	19				„ 25	3	2			
„ 8	25	12				„ 26	1	—			
„ 9	30	13				„ 27	1	1			
„ 10	27	12				„ 28	2	—			
„ 11	29	16				„ 29	—	—			
„ 12	21	19				„ 30	4	3			
„ 13	24	16	„ 16	171	95	Dec. 1	2	1	Dec. 4	9	6
„ 14	27	9				„ 2	—	1			
„ 15	24	11				„ 3	—	—			
„ 16	19	12				„ 4	1	1			
„ 17	33	17				„ 5	1	1			
„ 18	19	15				„ 6	3	—			
„ 19	26	11				„ 7	1	—			
„ 20	29	18	„ 23	145	104	„ 8	2	1	„ 11	8	3
„ 21	20	15				„ 9	—	—			
„ 22	15	11				„ 10	—	—			
„ 23	10	17				„ 11	1	1			
„ 24	17	6				„ 12	1	—			
„ 25	17	8				„ 13	1	—			
„ 26	16	10				„ 14	—	—			
„ 27	14	4	„ 30	102	56	„ 15	2	—	„ 18	6	1
„ 28	16	10				„ 16	—	—			
„ 29	11	11				„ 17	1	1			
„ 30	11	7				„ 18	1	—			
„ 31	20	5				„ 19	—	—			
Nov. 1	18	8				„ 20	4	2			
„ 2	13	12				„ 21	—	—			
„ 3	18	12	Nov. 6	105	52	„ 22	1	—	„ 25	6	3
„ 4	8	7				„ 23	—	—			
„ 5	15	2				„ 24	1	1			
„ 6	13	6				„ 25	—	—			
„ 7	12	10				„ 26	—	—			
„ 8	7	5				„ 27	1	—			
„ 9	6	1				„ 28	1	—			
„ 10	5	6	„ 13	47	30	„ 29	—	—	*„ 31	3	—
„ 11	9	1				„ 30	1	—			
„ 12	6	3				„ 31	—	—			
„ 13	2	4									
									Total -	889	499

* Six days only.

From the following Table XLII. (for which I am indebted to M. Josef Körösi), in which are given the mortality statistics of cholera recorded in the city of Budapest during the several epidemics that have occurred there since 1831, it will be seen that both the total number and the proportion per 10,000 of the population were less in the epidemic of 1892–93 than in any previous epidemic, but that the recorded fatality (56·1) was greater than that observed at any former epidemic period except that of 1831, when the per-centage of attacks to deaths was 57·1.

Table XLII.

Showing the Total Number of Cholera Attacks and Deaths recorded in the several Cholera Epidemics in Budapest since 1831 with the Rates per 10,000 of the Population.

Year.	Date of Commencement of Epidemic.	Date of Termination of Epidemic.		Number of Recorded Cholera		Rate per 10,000 of Population. Cholera		Deaths per cent. of Recorded Attacks "Fatality."
				Attacks.	Deaths.	Attacks.	Deaths.	
1831	July 14	September 25	Pest	2,450	1,526	874	234	62·4
			Buda	2,400	1,240	622	322	51·7
			Budapest	4,850	2,766	480	257	57·1
1854–55	October 5	November 1855	Pest	3,520	1,848	313	160	52·5
			Buda	1,477	507	290	96	34·3
			Budapest	4,997	2,355	473	129	47·1
1866	- - -	- - -	Pest	4,082	1,944	360	168	47·7
			Buda	1,240	538	189	82	43·5
			Budapest	5,322	2,485	518	402	46·7
1872–73	October 27	September 30, 1873, Budapest		5,584	2,558	239	111	48·5
1886	September 2	November 28	„	1,322	565	30	14	42·7
1892–93	September 20	February 6, 1893	„	935	525	18	10	56·1

From the official Report on Cholera at Budapest, by Professor Ludwig Gebhardt,* it appears that the use of Danube water was regarded to have been the chief factor in causing the spread of the disease in that city, it being stated that cholera attacked for the most part such persons as had drunk Danube water, whether filtered or unfiltered, whilst, on the other hand, those who had obtained their water supply from springs, or who had boiled the water obtained from the public supply, generally enjoyed immunity. The level of the ground water and the circumstances of the soil were not considered as having exercised any influence.

In the following Table XLIII. the character of the water used by persons attacked by cholera at Budapest in 1892–3 is given so far as it could be ascertained. It is to be noted that there are no data available as to the number of persons using water of one or another character who were not attacked by cholera.

* See note §, page 117, *ante*.

TABLE XLIII.

SHOWING the CHARACTER of the WATER used by PERSONS attacked by CHOLERA at BUDAPEST 1892–93.

Character of Water used.		Number of Persons.
Public supply	Unfiltered	356
	Filtered	406
Water drawn from R. Danube		78
Spring water		8
Source of water supply not known		87
Total		935

The chief centres of the disease in Hungary (exclusive of small farms &c.) are given in Table XLIV.

TABLE XLIV.

TABLE showing the several TOWNS and VILLAGES situate in HUNGARY in which CHOLERA was exceptionally prevalent during 1892.

County.	Town or Village.	Population.	Number of recorded Cholera.		Rate per 10,000 Population Cholera.		Deaths per cent. of recorded Attack "Fatality."
			Cases.	Deaths.	Cases.	Deaths.	
Arad	Uj-Panát	2,098	11	7	*52·6*	*33·3*	*63·6*
Bács-Bodrog	Ada	9,693	17	12	*17·5*	*12·4*	*70·6*
	Szónta	5,008	20	12	*40·0*	*24·0*	*60·0*
	Szántova	3,358	14	10	*41·7*	*29·9*	*71·5*
	Zenta	26,000	38	24	*14·6*	*9·2*	*63·2*
	Titel	4,314	35	22	*81·1*	*51·0*	*62·9*
Baranya	Mohács	14,468	38	19	*26·3*	*13·1*	*50·0*
Esztergom	Táth	937	21	10	*224·0*	*106·6*	*47·7*
	Sárisáp	1,330	34	9	*255·6*	*67·7*	*26·5*
Fejér	Ercsi	5,670	27	12	*47·5*	*21·1*	*44·5*
	Erd	3,337	30	16	*90·0*	*45·0*	*53·3*
	Rácz-Almas	3,603	12	7	*33·3*	*19·4*	*58·3*
Jász-Nagy-Kun-Szolnok.	Szolnok	20,640	34	20	*16·5*	*9·7*	*58·8*
Komárom	Guta	7,088	18	7	*25·4*	*9·9*	*38·8*

County.	Town or Village.	Population.	Number of recorded Cholera		Rate per 10,000 Population Cholera		Deaths per cent. of recorded Attack: "Fatality."
			Cases.	Deaths.	Cases.	Deaths.	
Liptó	Liszkófalu	1,530	14	5	86·0	30·7	35·7
	Liptó-Pepla	703	11	5	156·5	71·2	45·5
Pest - Pilis-Solt - Kis-Kun.	Uszód	2,372	15	8	63·3	33·8	53·3
	Nagy-Tétény	2,426	15	5	61·9	20·6	33·3
	Foktó	3,542	13	6	36·7	16·9	46·2
	Soroksár	12,147	24	16	19·8	13·2	66·6
	Vácz	14,600	13	10	8·9	6·9	77·0
Sopron	Kapuvár	6,000	31	15	51·7	25·0	48·4
Torontál	N.—Becskerek	21,934	64	33	29·2	15·0	51·6
	M.—Ittebe	2,243	20	13	89·2	58·0	65·0
	Szerb-Ittebe	4,802	28	19	55·8	39·6	67·7
	Szerb-Aradácz	1,896	179	114	944·0	601·0	63·7
	Tóba	1,695	17	5	100·3	29·5	29·4
Trencsén	Sebestyénfalu	333	15	10	450·0	300·0	66·6
—	Budapest	491,938	889	499	18·1	10·1	56·1
—	Szeged	85,569	38	28	4·4	3·3	73·7

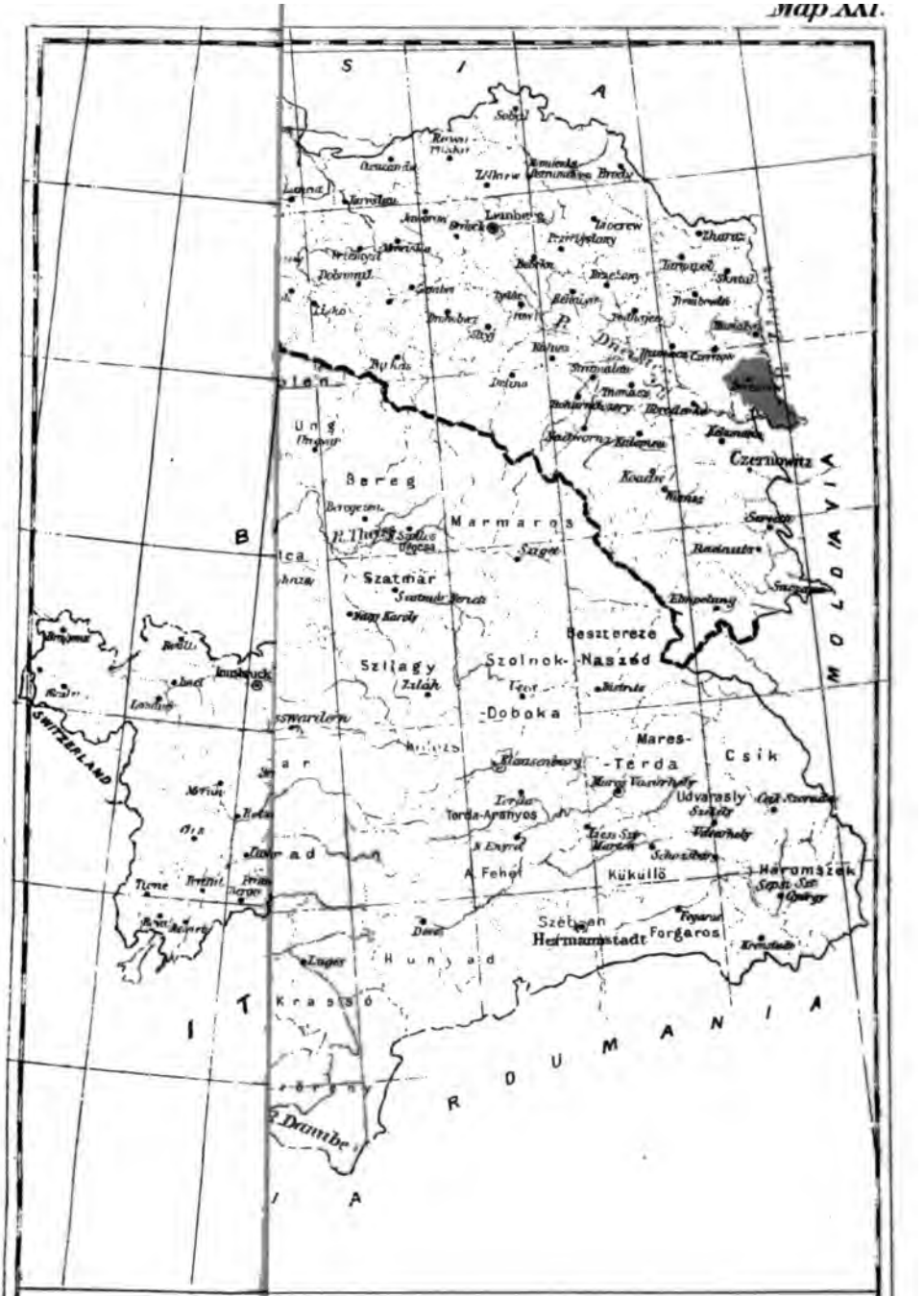
Of all places in Hungary, the village of Szerb-Aradácz in proportion to its population suffered the most severely. This village which has a population of 1,896 is situate in the county of Torontál on the River Theiss, and here 179 attacks, of which 114 were fatal, were recorded in the course of some four weeks, these figures being equivalent to an attack-rate of 944 and a death-rate of 601 per 10,000 of the population. As to the circumstances of this outbreak no *data* have been received in this country.

The statistics of cholera in the several towns and villages of Hungary are given in Table E.* (2) appended to this report, and the relative mortality from cholera in the several counties and municipal towns is shown graphically in Map XXI.

United States.

On August 31st, the S.S. "Moravia" arrived at New York with immigrants from Hamburg. The vessel had left Hamburg on August 18th, with 358 steerage passengers, and of these 22 were reported to have died of cholera on the voyage. The first death occurred on August 19th, and the last on August 29th. Upon arrival all on board were apparently in good health. The vessel was at once placed in quarantine,

* By the kindness of M. Josef Körösi, the Director of Municipal Statistics at Budapest, I am enabled to include in this table, as regards the majority of the invaded counties, the dates upon which the first cases of cholera were observed. This information, which was specially obtained from the Hungarian Ministry of the Interior, reached me too late to be incorporated in the text of this report.



Mortality per 10,

Under 0·75 [ ] *p shewing the Distribution of Cholera*

1·5 to 3·0 [ ] *rtality in the several Departments and*

(Mean Cholera *ounties of Austro-Hungary in 1892.*

Invaded Depar

of Austro-Hun

and the removal of the immigrants to the New York quarantine station at Hoffman's Island ordered. Further cases of cholera subsequently occurred amongst the passengers on board this vessel.

In view of the danger of the importation of cholera to the United States by means of immigrants from infected countries stringent quarantine regulations were imposed by a Circular, dated September 1st, issued by authority of President Harrison. According to this Circular it was ordered "that no vessel from any foreign port, carrying immigrants, "shall be admitted to enter at any port of the United States until "said vessel shall have undergone a quarantine detention of twenty "days (unless such detention is forbidden by the laws of the State, "or the regulations made thereunder), and of such greater number of "days as may be fixed in each special case by the State Authorities."

This circular was to take immediate effect, except as regard vessels already afloat, such vessels to be made the subject of special consideration. The effect of the issue of this circular was practically to suspend further shipment of immigrants for the United States.

Between September 1st and September 16th six other vessels "infected" or "suspected to be infected" with cholera arrival at New York. The following were the vessels in question: "Rugia," Normannia," "Heligoland," "Wyoming," "Scandia," and "Bohemia," all hailing from Hamburg, with the exception of the "Wyoming," from Liverpool. All these vessels, with the exception of the "Heligoland," carried immigrants, and had sailed prior to the issue of the President's Circular. Each of these vessels was placed in quarantine upon its arrival, but the accommodation at the quarantine stations at Swinburne's Island and at Hoffman's Island was found to be insufficient for the large number of persons to be dealt with—the "Scandia" alone had 27 cabin and 981 steerage passengers, together with a crew of 77 hands—and much hardship and discomfort had to be undergone by the passengers on some of the vessels, especially those brought by the "Normannia," a vessel which arrived at New York on September 3rd. In order to provide adequate accommodation, the State acquired Fire Island as an additional quarantine station, but the inhabitants of the island and neighbouring mainland offered an armed resistance to the landing of passengers, and it was not until the militia had been called out that this resistance could be overcome.

The total number of cases of cholera reported to have occurred amongst persons arriving at New York by the seven vessels referred to above were 72 in number, and of these 44 proved fatal (1 in August and 43 in September).

Prior to the arrival of these vessels at New York, 76 deaths from cholera had occurred at sea: on the "Moravia" 22, "Normannia" 5, "Rugia" 4, "Bohemia" 11, and "Scandia" 34.

The first case of cholera on land in the United States occurred in New York City on September 6th six days after cholera had appeared in the harbour, but the announcement was delayed until September 14th, by which date seven cases in all had occurred, of which six had proved fatal. This delay was stated to be due to the time required for the bacteriological examination, the presence of the comma spirillum being made the diagnostic test in all cases.*

Only 10 cases of cholera were recorded to have taken place in New York during 1892, and of these the last case occurred on September 29th. Of the 10 persons attacked 9 died.

* Sixteenth Annual Report of the Board of Health of the State of New Jersey, 1892, p. 493.

On September 18th, at New Brunswick in New Jersey, a man in charge of a canal boat died of cholera, having been attacked by the disease the previous day. This man had brought his boat to New Brunswick from New York Harbour, where it had been lying for a month, on September 16th.

In October five suspected cases of cholera, of which two proved fatal, were reported to have occurred at New Grahaick, a suburb of North Tonawanda, in the State of New York.

The total cases of cholera recorded as having occurred in 1892 in the United States were 88 in number, and of these 56 were fatal. They were distributed as follows :—

——	Attacks.	Deaths.
New York City - - - - -	10	9
New York Bay - - - - -	72	44
Grahaick (New York) - - - -	5	2
New Brunswick (New Jersey) - - -	1	1
	88	56

Servia.

Towards the end of October Servia was invaded by cholera from Hungary, and subsequently a few cases occurred in towns situated on the banks of the Danube, but there was no serious extension of the disease in the country during 1892. Cholera first appeared at Semendria on October 7/19, and was from thence transmitted to Belgrade on October 12/24. At Semendria seven attacks, of which five proved fatal, were reported to have occurred during 1892. At Belgrade 18 persons were reported to have been attacked by cholera up to November 10/22, after which no further cases are said to have occurred. Of the 18 persons attacked, 12 died. During October and November the appearance of six cases of cholera was reported amongst workmen at the Iron Gates, of which two were fatal. The only other town in Servia reported to have been infected by cholera was Dragojevatz, a town situate in the county of Podringe, and lying to the south of and in direct railway communication with Belgrade. At this place two isolated attacks attributed to cholera took place on October 29th and November 8th, respectively, and of these one proved fatal. With this exception all the places in Servia invaded by cholera were situate on the Danube. The total number of cases of cholera reported as having occurred in Servia was 33, of which 9 proved fatal. With the exception of two or three soldiers, all the persons attacked by cholera belonged to the lower working classes.

For the above information with respect to cholera in Servia, I am indebted to His Excellency M. Alex. Z. Yovichetch, Chargé d'Affaires in London for the Kingdom of Servia.

Turkey in Asia.

Arabia.

The occurrence of an independent diffusion of cholera in Arabia in 1892 has already been referred to earlier in this report. I now propose to refer briefly to this diffusion, which, so far as is known, did not extend into Europe during the year under review.

Cholera, which has prevailed extensively in the Vilayets of Hedjaz, and of Yemen in Arabia during 1891, was reported to have almost ceased during the first quarter of 1892. It appears, however, from a report made by Dr. Malézian, who was stationed at Kameran, that in April 1892, some cases of cholera occurred amongst the Turkish troops who were assembled in camp at Hadie, but did not apparently spread to any extent amongst the civilian population. In May a military expedition was undertaken against the fortress of Zafir, three hours distant from Hadie. On June 24th, Zafir was taken by the troops, and immediately afterwards cholera appeared amongst the inhabitants of the place. On July 15th, a violent outbreak of cholera is reported to have occurred in a battalion of soldiers who had marched from Hadie to Zurak, a place three hours distant. On July 31st, the troops who had been engaged in the operations against Zafir returned to Hadie and amongst them isolated cases of cholera appeared. On August 15th, an extensive outbreak occurred amongst six battalions of troops who were at that time collected together at Hadie. On August 21st, three of these battalions were sent to the headquarters at Raho and there joined five other battalions which had not hitherto been affected by cholera. These eight battalions were employed in military operations against Chahil, and, on August 25th, cases of cholera appeared amongst the men of one of the five battalions which had not up to that date suffered, and after the troops had crossed the Wady Mur there followed such an extension of the disease that by September 5th 400 of the men had died. After the taking of Chahil, the troops were ordered in different directions, and are said to have spread cholera wherever they went. A large number were sent to the quarantine station on the Island of Kamaran, and, on September 28th, it was reported that of 4,000 troops undergoing quarantine there, upwards of 150 had died from cholera, and that three of the quarantine guards also had succumbed to the disease. Upon their release from quarantine the troops were shipped to Syria and to Asia Minor.

In the meantime a re-introduction of cholera into the Vilayet of Yemen from the Somali coast had taken place under the following circumstances. On August 20th, a vessel from the Somali coast is stated to have landed some 400 slaves at the little harbour of Maidi. These slaves were at once taken on to Boni-Djama, at which place cholera almost immediately made its appearance and spread to the villages round. Some of the slaves were taken to the port of Loheia, and there also cholera followed their introduction. Shortly afterwards cholera appeared at Beit-el-Fakih on the road to Hodeidah, first amongst soldiers, and afterwards amongst the civil population. Here the disease spread rapidly, and, by September 29th, it was reported that 1,172 persons had been attacked, and that of these 374 had died. Cholera is also reported to have appeared in other towns and villages in the neighbourhood of Hodeidah, but no reliable records as to these are available.

Africa.

Somaliland.

Early in April cholera was reported to be prevalent on the Somali Coast between Zeila and Berber, the disease being said to have been introduced by vessels from the coast of Yemen in Arabia. On April 29th, it was reported to have made its appearance at Harrar, where it caused great mortality. The information with respect to the prevalence of cholera in the Somali country is extremely meagre, but

from despatches from Aden it would appear to have diminished in its intensity towards the end of July. The following figures with respect to the estimated deaths due to cholera are taken from a report* presented to the Italian Government by Prof. Pagliani.

Name of Place.	Deaths from Cholera.
Ras Djubouti - -	300
Zeilah - - -	400
Berber - - -	300
Bulhar - - -	500
Harrar - - -	8,500
Total - -	10,000

The diffusion of cholera in Arabia in 1892, reported above, is of especial interest as it was due to an invasion, which had taken place in 1891 along the Red Sea pilgrim route, and which, as has already been seen, had early in 1892 been transmitted to the Somali coast of Africa, again returning from thence. This cholera epidemic was quite distinct from that which had invaded Europe by way of Russia, and from that which had arisen in the neighbourhood of Paris, and it was in all probability to this 1891 cholera that the epidemic which caused such ravages at Mecca in the pilgrimage of 1893 was primarily due.

* Consiglio Superiore di Sanità. Circa i fatti principali riquardanti l'igiene e la sanità pubblica nel regno nei due ultimi quadrimestri, 1892.
Relazione del Direttore Prof. L. Pagliani letta nella soduta del 17 Dicembre 1892.
Roma, 1892.

DETAILED TABLES appended to DR. BARRY'S REPORT.

TABLE A.

CHOLERA in FRANCE during 1892.

Department.	Commune.	Population, Census 1891.	Date of first recorded Death from Cholera, 1892.	Total Deaths recorded from Cholera, 1892.	Cholera Death-rate per 10,000 Population.	Date of last recorded Death from Cholera, 1892.
Seine	Nanterre	10,430	March 31	67	64·2	Sept. 16
	Neuilly	29,444	April 13	32	10·8	Oct. 5
	Puteaux	17,646	„ 13	53	30·0	Nov. 5
	Ile-Saint-Denis	2,268	„ 13	9	39·7	Sept. 29
	Courbevoie	17,597	„ 15	38	21·6	Oct. 1
	Saint-Denis	50,992	„ 17	104	20·4	Dec. 4
	Vanves	6,815	„ 18	3	4·4	Sept. 26
	Colombes	18,918	„ 18	21	11·1	Oct. 31
	Levallois-Perret	39,857	„ 21	68	17·1	„ 17
	Suresnes	8,404	„ 24	20	23·8	Oct. 11
	Saint-Ouen	25,969	„ 30	142	54·6	„ 22
	Clichy	30,698	May 4	46	14·2	Nov. 4
	Paris	2,424,705	„ 16	907	4·2	Dec. 26
	Asnières	19,575	„ 24	25	12·7	Nov. 2
	Boulogne-sur-Seine	32,569	June 2	31	9·5	Oct. 17
	Montreuil-sous-Bois	23,986	„ 6	19	7·9	Dec. 13
	Maisons Alfort	7,853	„ 7	4	5·1	Aug. 28
	Aubervilliers	25,022	„ 11	134	53·9	Oct. 13
	Pantin	21,847	„ 23	39	17·8	Dec. 17
	La Courneuve	1,542	„ 29	6	[38·9	?
	Villemomble	3,725	„ 18	1	2·6]	?
	Issy	12,830	„ 23	7	5·4	Sept. 10
	Gennevilliers	5,837	„ 27	13	22·2	„ 28
	Gentilly	15,017	„ 29	7	4·6	„ 30
	Malakoff	9,144	July 5	1	[1·1]	July 5
	Pré-Saint-Gervais (Le)	8,138	„ 6	2	2·4	Sept. 4
	Le Bourget	2,258	„ 7	6	26·6	Aug. 6
	Epinay	2,591	„ 7	7	27·0	„ 15
	Saint-Maur	17,333	„ 8	4	2·2	Sept. 8
	Dugny	611	„ 16	1	[16·4]	?
	Pierrefitte	1,824	„ 25	2	10·9	„ 4
	Alfortville	7,984	Aug. 2	3	3·7	„ 22
	Choisy-le-Roi	8,449	„ 7	2	2·4	Aug. 24
	Charenton	15,306	„ 16	5	3·2	Oct. 3
	Saint-Maurice	6,653	„ 22	3	4·5	Aug. 26
	Ivry	22,357	„ 23	7	3·1	Oct. 16
	Vitry-sur-Seine	7,161	„ 23	2	2·7	„ 4
	Romainville	2,106	„ 24	2	9·5	Sept. 26
	Bondy	3,638	„ 25	5	1·4	„ 6
	Bagnolet	6,124	„ 27	1	[1·6]	Aug. 7
	Bobigny	1,540	Sept. 1	2	13·0	Sept. 22
	Nogent-sur-Marne	8,399	„ 4	2	2·4	Oct. 5
	Arcueil	6,088	„ 22	1	[1·6]	Sept. 22
	Le Perreux	6,699	„ 23	1	[1·4]	„ 23
	Vincennes	24,626	Nov. 10	2	0·4	Dec. 11
	Villejuif	4,294	„ 23	1	[2·3]	Nov. 23
Seine Inférieure.	Saint-Aignan	3,379	April 7	15	44·4	Dec. 9
	Monchaux-Sorang	341	July 1	2	58·7	Sept. 23
	Canteleu	3,630	„ 11	6	16·5	„ 18
	Havre	116,369	„ 15	498	42·7	Oct. 25
	Sierville	701	Aug. 1	2	28·5	Sept. 17
	Tocqueville-en-Caux	329	„ 6	1	[30·4]	Oct. 6
	Rouen	112,352	„ 12	72	6·4	Dec. 22

App. A. No. 12. TABLE A.—*continued.*

Department.	Commune.	Population, Census 1891.	Date of first recorded Death from Cholera, 1892.	Total Deaths recorded from Cholera, 1892.	Cholera Death-rate per 10,000 Population.	Date of last recorded Death from Cholera, 1892.
Seine Inférieure—*cont.*	Sanvic	6,380	Aug. 13	15	21·8	Oct. 15
	Graville-Ste-Honorine	7,500	„ 15	64	85·3	„ 13
	Dieppe	22,771	„ 17	79	34·7	„ 29
	Sotteville-lès-Rouen	16,386	„ 18	11	6·7	Sept. 18
	Hermanville	176	„ 21	4	227·5	„ 16
	Bléville	2,843	„ 23	10	35·1	„ 27
	Caudebec	2,336	„ 23	8	34·3	Dec. 12
	Gueures	737	„ 23	15	203·5	Oct. 5
	Darnétal	6,460	„ 24	2	3·1	Aug. 30
	Harfleur	2,307	„ 24	9	39·0	Sept. 28
	Amfréville-la-Mi-Voie	1,376	„ 25	1	[7·3]	Aug. 25
	Greges	281	„ 25	2	71·2	Oct. 16
	Neuville-les-Dieppe	2,136	„ 25	2	9·4	Sept. 27
	Lillebonne	6,500	„ 26	3	4·6	Aug. 29
	Flamets-Frètils	358	„ 27	4	111·8	Sept. 27
	Martin-Église	513	„ 27	1	[19·5]	Aug. 27
	Monville	2,520	„ 28	11	43·6	Nov. 30
	Epouville	700	„ 29	5	71·5	Sept. 8
	Petit-Couronne (Le)	771	„ 29	5	64·9	„ 17
	Criquetot-d'Esneval	1,424	„ 30	1	[7·0]	Aug. 30
	Ouainville	528	Sept. 1	1	[19·0]	Sept. 1
	Elbeuf	21,404	„ 5	10	4·7	Oct. 10
	Gournay	3,829	„ 5	4	10·4	Sept. 15
	Ambrumesnil	406	„ 5	1	[24·6]	Oct. 5
	Notre Dame de Bondeville.	2,859	„ 6	4	14·0	„ 8
	Rouelles	630	„ 6	1	[15·9]	Sept. 6
	Fontaine-le-Mallet	682	„ 7	1	[14·7]	„ 7
	Vatteville	908	„ 8	6	66·1	Oct. 14
	Fécamp	13,577	„ 8	3	2·2	Sept. 25
	Veules	964	„ 9	3	31·1	„ 12
	Val-de-la-Haye	382	„ 9	1	[26·2]	„ 9
	Belbeuf	605	„ 10	2	33·1	„ 12
	Sotteville-sur-Mer	788	„ 11	2	25·4	„ 19
	Sahurs	550	„ 11	1	[18·2]	Sept. 11
	Aumale	2,219	„ 13	4	18·0	Nov. 14
	Dampierre	542	„ 14	1	[18·4]	Sept. 14
	Montivilliers	5,344	„ 14	10	18·7	Oct. 24
	Cuy-St.-Fiacre	423	„ 15	1	[23·6]	Sept. 15
	Tréport (Le)	4,569	„ 15	21	46·0	Oct. 18
	Saint-Paër	978	„ 15	2	20·4	„ 6
	Petit-Quevilly (Le)	10,688	„ 18	1	[0·9]	Sept. 18
	Ste-Agathe-d'Aliermont	301	„ 19	1	[33·2]	„ 19
	Offranville	788	„ 19	1	[12·7]	„ 19
	Thil-Manneville	501	„ 20	1	[20·0]	„ 20
	Saint-Martin-du-Manoir	518	„ 20	1	[19·3]	Sept. 20
	Omonville	252	„ 21	1	[39·6]	„ 21
	Bolbec	12,028	„ 21	2	1·7	Oct. 6
	Saint-Aubin-sur-Scie	676	„ 25	2	29·6	Sept. 30
	Pavilly	2,957	„ 26	1	[3·5]	„ 26
	Lintot	577	„ 26	1	[17·3]	„ 26
	Houlme (Le)	2,128	„ 28	3	14·1	Dec. 24
	Luinésy	1,163	„ 29	1	[8·6]	Sept. 29
	Eu	4,693	„ 30	3	6·4	Oct. 16
	Saint-Maurice-d'Etelan	328	„ 30	1	[29·8]	Sept. 30
	Neufchâtel	4,006	Oct. 1	1	[2·5]	Oct. 1
	Barentin	4,418	„ 2	1	[2·3]	„ 2

TABLE A.—*continued.* APP. A. No. 12.

Department.	Commune.	Population, Census 1891.	Date of first recorded Death from Cholera, 1892.	Total Deaths recorded from Cholera, 1892.	Cholera Death-rate per 10,000 Population.	Date of last recorded Death from Cholera, 1892.
Seine Inférieure—*cont.*	La Poterie	514	Oct. 10	1	[19·5]	Oct. 10
	Sainte-Adresse	2,511	„ 11	2	7·9	„ 13
	Forges-les-Eaux	1,867	„ 15	1	[5·4]	„ 15
	Saint-Saëns	2,399	„ 17	3	12·5	„ 31
	Cottévrard	263	„ 19	2	76·0	„ 20
	Landes-vielles-et-neuves	208	„ 21	1	[48·0]	„ 21
	Fontaine-le-Bourg	1,434	„ 21	1	[7·0]	„ 21
	Vieux Rouen	470	„ 25	1	[21·3]	„ 25
	Étalondes	348	„ 26	1	[28·7]	„ 26
	Mesnil-Panneville	499	„ 31	2	40·0	Nov. 5
	Grande-Couronne	1,463	Nov. 1	4	27·3	„ 18
	Torcy-le-Grand	607	„ 1	3	49·4	„ 14
	Malaunay	2,062	„ 7	1	[4·8]	„ 7
	Touffreville-sur-Eure	268	„ 22	3	112·3	Dec. 4
	Yvetot	7,617	„ 23	4	5·2	Nov. 26
	Louvetot	?	„ 24	3	?	„ 29
Seine et Oise	Argenteuil	13,339	April 16	122	91·5	Sept. 11
	Poissy	6,432	May 14	2	3·1	May 18
	Beaumont-sur-Oise	3,099	June 24	18	58·0	Sept. 3
	Bezons	2,406	„ 28	8	33·2	July 19
	Montmorency	4,577	July 6	6	13·1	Sept. 29
	Pontoise	7,422	„ 7	6	8·1	„ 10
	Enghien	2,670	„ 8	5	18·7	Aug. 17
	Gonesse	2,642	„ 12	22	83·2	Sept. 6
	Blanc-Mesnil (Le)	165	„ 13	2	121·0	July 22
	Groslay	1,233	„ 15	1	[8·1]	„ 15
	Marly-la-Ville	845	„ 19	4	47·3	Sept. 10
	Sarcelles	2,118	„ 21	45	202·0	„ 2
	Hardricourt	290	„ 30	3	103·5	Dec. 29
	Villiers-le-Bel	1,649	Aug. 1	3	15·2	Aug. 5
	Ezanville	199	„ 17	1	[50·5]	„ 17
	Survilliers	526	„ 20	1	[19·0]	„ 20
	Vau d'Herland	69	„ 26	1	[145·0]	„ 26
	Versailles	51,679	„ 31	3	0·6	Sept. 29
	Neully-sur-Marne	6,374	Sept. 1	1	[1·6]	„ 1
	Éragny	412	„ 2	1	[24·3]	„ 2
	Bougival	2,823	„ 3	1	[3·5]	„ 3
	Raincy (Le)	5,477	„ 5	1	[1·8]	„ 5
	Livry	3,238	„ 15	2	6·2	„ 16
	Isle-Adam (L')	3,470	„ 17	2	5·8	„ 24
	Taverny	2,042	„ 23	1	[4·9]	„ 23
	Chatou	3,580	„ 26	1	[2·8]	„ 26
	Noisy-le-Roi	653	„ 29	1	[15·3]	„ 29
	Rueil	9,937	Oct. 4	3	3·0	Oct. 17
Oise	Boran	748	May 6	1	[13·4]	May 6
	Marolles	607	June 26	6	98·8	Sept. 4
	Bresles	2,199	July 18	1	[4·5]	July 18
	Clermont	5,617	Aug. 20	1	[1·8]	Aug. 20
	Chantilly	4,231	„ 21	6	14·2	Oct. 17
	Saint-Samson	418	„ 24	1	[23·9]	Aug. 24
	Beauvais	19,382	„ 31	5	2·6	Sept. 27
	Saint-Firmin	1,095	Sept. 3	1	[9·1]	„ 3
	Ermenonville	487	„ 7	1	[20·5]	„ 7
	Escles	217	„ 8	1	[46·0]	„ 8
	Allonne	2,303	„ 10	1	[4·3]	„ 10

App. A. No. 12.

TABLE A.—*continued.*

Department.	Commune.	Population, Census 1891.	Date of first recorded Death from Cholera, 1892.	Total Deaths recorded from Cholera, 1892.	Cholera Death-rate per 10,000 Population.	Date of last recorded Death from Cholera, 1892.
Oise—*cont.*	Longueil-Sainte-Marie	966	Sept. 11	3	*31·0*	Oct. 13
	Varinfroy	132	„ 15	1	[75·7]	Sept. 15
	Thury	475	„ 21	1	[21·0]	„ 21
	Montépilloy	207	„ 24	1	[48·4]	„ 24
	Gouvieux	2,117	„ 26	3	*14·2*	Oct. 5
	Mareuil-sur-Ourcq	740	„ 27	1	[13·5]	Sept. 27
	Compiègne	14,498	„ 30	3	*2·1*	Oct. 20
	Montataire	5,296	Oct. 3	9	*17·0*	Nov. 10
	Chevreville	366	„ 4	1	[27 3]	Oct. 4
	Fontenay-Torcy	258	„ 11	1	[38·7]	„ 11
	Chevrières	815	„ 18	1	[12·3]	„ 18
	Saint-Maximin	1,354	„ 19	8	*59·1*	Nov. 25
	Courteuil	241	„ 21	1	[41·5]	Oct. 21
	Sempigny	445	„ 24	1	[22·5]	„ 24
	Songeons	1,056	Nov. 8	1	[9·5]	Nov. 1
Marne	Vitry-le-François	8,022	June 12	1	[1·2]	June 12
	Pont-Faverger	2,233	Aug. 24	1	[4·5]	Aug. 24
	Dizy Magenta	2,462	Nov. 30	5	*20·3*	Dec. 13
Gard	Nîmes	71,623	June 27	5	*0·7*	Dec. 23
Basses-Pyrénées	Briscous	1,517	July 10	10	*65·9*	Sept. 9
Bouches-du-Rhône	Marseille	403,749	July 12	89	*2·2*	Nov. 13
	Allauch	3,073	Oct. 11	1	[3·3]	Oct. 11
Seine-et-Marne	Juilly	1,073	July 13	2	*18·6*	July 16
	Mitry-Mory	1,823	Aug. 26	1	[5·5]	Aug. 26
	Clay-Souilly	1,936	Sept. 4	1	[5·2]	Sept. 4
	Meaux	12,833	„ 5	7	*5·5*	Nov. 5
	Trilbardeau	381	„ 7	1	[26·2]	Sept. 7
	Monsigny	?	„ 13	1	[?]	„ 13
	Guérard	1,278	„ 14	1	[7·8]	„ 14
	Congis	778	„ 16	5	*64·3*	Oct. 27
	Crégy	367	„ 20	1	[27·2]	Sept. 20
	Chauconin	212	„ 28	1	[47·1]	„ 28
	Isles-lès-Villenoy	236	Oct. 18	1	[42·3]	Oct. 18
	Fontainebleau	14,222	„ 4	1	[0·7]	„ 4
Finistère	Pont-Croix	2,496	July 14	1	[6·7]	July 14
	Plougeau	3,088	„ 24	1	[3·2]	„ 24
	Plouvorn	3,130	Sept. 18	1	[3·2]	Sept. 13
	Sainte-Sève	598	Oct. 19	1	[16·7]	Oct. 19
	Quimper	17,406	„ 29	3	*1·7*	Nov. 8
	Tréméven	1,072	Nov. 24	1	[9·4]	„ 24
	Quimperlé	8,049	Dec. 5	1	[1·2]	Dec. 5
	Lambézellec	16,084	„ 24	3	*1·9*	„ 26
Eure-et-Loir	Bonneval	3,789	July 18	35	*92·3*	Sept. 9
	Meslay-le-Vidame	515	Sept. 2	1	[19·4]	„ 2
	Brou	2,656	„ 22	1	[3·8]	„ 22
	Boissy-le-Sec	610	„ 24	1	[16 4]	„ 24
Somme	Terramesnil	756	July 18	2	*26·4*	July 20
	Beauval	3,709	„ 20	1	[2·7]	„ 20
	Estrées-Deniécourt	500	Sept. 4	1	[20·0]	Sept. 4

TABLE A.—*continued.* APP. A. No. 12.

Department.	Commune.	Population, Census 1891.	Date of first recorded Death from Cholera, 1892.	Total Deaths recorded from Cholera, 1892.	Cholera Death-rate per 10,000 Population.	Date of last recorded Death from Cholera, 1892.
Somme—*cont.*	Villers-Brétonneaux	5,625	Sept. 11	1	[1·8]	Sept. 1
	Quivières	378	„ 24	3	79·5	Oct.
	Roye	3,931	Oct. 3	2	5·1	„
	Hem	417	„ 16	1	[24·0]	„ 1
	Abbeville	19,851	„ 21	19	9·6	Dec. 2
	Thieulloy-la-Ville	205	„ 27	1	[48·8]	Oct. 2
	Beaucamps-le-Vieux	1,797	„ 28	1	[5·6]	„ 2
	Gaucourt-sur-Somme	?	Nov. 8	2	?	Nov. 1
	Pont-Remy	1,426	„ 11	2	14·0	„ 1
	St. Léger-le-Pauvre	78	„ 14	2	256·5	„ 2
	Quesne (Le)	267	„ 28	1	[37·5]	„ 2
Dordogne	Salon	507	July 19	2	39·4	July 2
Côte-d'Or	Dijon	65,428	„ 21	1	[0·1]	„ 2
Meurthe-et-Moselle	Nancy	87,110	„ 26	2	0·2	Sept.
	Hondreville	597	Oct. 4	8	134·0	Oct. 1
Yonne	Auxerre	18,036	July 27	1	[0·6]	July 2
Nord	Bruay	4,934	„ 28	1	[2·0]	July 2
	Saint-Amand	12,043	Aug. 2	1	[0·8]	Aug.
	Denain	18,258	„ 19	10	5·5	„ 2
	Dunkerque	39,498	Sept. 1	35	8·9	Dec. 2
	Trith-Saint-Léger	3,537	„ 1	12	33·9	Nov. 2
	Saint-Saulve	2,751	„ 2	4	14·5	Sept. 1
	Maing	2,391	„ 4	14	58·6	Oct.
	Valenciennes	28,700	„ 5	4	1·4	Sept. 2
	Préseau	2,086	„ 6	1	[4·8]	„
	Sebourg	1,691	„ 12	1	[5·9]	„ 1
	Douai	29,909	„ 15	1	[0·3]	„ 1
	Douchy	2,650	„ 16	1	[3·8]	„ 1
	Aubry	1,165	„ 17	1	[8·6]	„ 1
	Steene	1,079	„ 23	6	55·6	Dec.
	Beuvrages	1,677	„ 24	4	23·8	Oct.
	Sin-le-Noble	6,502	„ 26	1	[1·5]	Sept. 2
	Marly	2,424	„ 29	1	[4·1]	„ 2
	Coudekerque-Branche	3,537	Oct. 2	2	5·7	Dec.
	Rosendaël	7,432	„ 9	3	4·0	Oct. 1
	Warhem	2,198	„ 12	1	[4·6]	„ 1
	Bray-Dunes	1,347	„ 15	2	14·8	„ 2
	Lourches	4,707	„ 15	1	[2·1]	„ 1
	Spycker	670	Nov. 3	1	[14·9]	Nov.
	Bourbourg-Ville	2,468	„ 11	3	12·1	„ 1
	Bourbourg-Campagne	2,744	„ 13	2	7·3	„ 1
	Cappelle	687	„ 13	1	[14·6]	„ 1
	Watten	1,948	„ 15	1	[5·1]	„ 1
	Craywick	515	„ 17	3	58·3	„ 2
	Saint-Momelin	307	„ 23	1	[32·6]	„ 2
	Grand-Fort-Philippe	2,842	„ 23	24	84·4	Dec. 2
	Petite-Synth	2,918	„ 27	1	[3·4]	Nov. 2
	Pitgam	1,549	Dec. 2	1	[6·5]	Dec.
	Bergues	5,380	„ 5	2	3·7	„
	Saint-Pol-sur-Mer	6,312	„ 6	4	6·3	„ 1
	Mortagne	1,173	„ 12	1	[8·5]	„ 1

App. A. No. 12.

TABLE A.—*continued.*

Department.	Commune.	Population, Census 1891.	Date of first recorded Death from Cholera, 1892.	Total Deaths recorded from Cholera, 1892.	Cholera Death-rate per 10,000 Population.	Date of last recorded Death from Cholera, 1892.
Indre-et-Loire	Tours	60,335	Aug. 1	2	0·3	Aug. 1
Vosges	Épinal	23,223	„ 1	2	0·9	Sept. 23
Haute-Marne	Saint-Dizier	13,372	„ 3	2	1·5	Aug. 4
Aude	Caux-et-Sauzens	527	„ 8	1	[19·0]	Aug. 8
Eure	Pacy-sur-Eure	1,926	„ 16	2	10·4	Sept. 5
	Fren use-sur-Risle	659	„ 24	8	121·4	„ 7
	Pont-Audemer	6,084	„ 26	25	41·1	„ 23
	Mennéval	870	„ 27	2	23·0	Oct. 21
	Serquigny	1,053	„ 28	3	28·5	Sept. 7
	Brionne	3,577	„ 29	35	97·8	Oct. 20
	Nassandres	590	Sept. 1	4	67·8	Sept. 5
	Manneville-sur-Risle	802	„ 2	3	37·4	„ 22
	Harcourt	884	„ 5	1	[12·0]	„ 5
	St. Pierre-de-Vouvray	599	„ 5	2	33·4	„ 6
	Boisney	339	„ 5	2	59·0	„ 11
	Perriers-la-Campagne	228	„ 7	3	131·6	„ 9
	Monfort-sur-Risle	635	„ 9	2	31·5	„ 15
	Calleville	414	„ 9	1	[24·2]	„ 9
	Bernay	8,016	„ 10	3	3·7	„ 15
	Porte-Joie	140	„ 12	1	[71·5]	„ 12
	St. Ouen-de-Thouberville.	802	„ 19	1	[12·5]	„ 19
	St. Mards-de-Blacarville	453	„ 26	1	[22·1]	„ 26
	Criquebeuf-sur-Seine	1,079	Oct. 6	1	[9·3]	Oct. 6
	Alizay	583	„ 12	1	[17·1]	„ 12
Sarthe	Les Mans	57,412	Aug. 20	5	0·9	Sept. 23
Charente-Inférieure.	Aigrefeuille	1,648	Aug. 21	1	[6·1]	Aug. 21
	St. Georges-de-Cubillau	407	Sept. 15	1	[24·6]	Sept. 15
	Bussac	555	„ 16	1	[18·0]	„ 16
	Mazeray	607	„ 24	1	[16·5]	„ 24
	La Rochelle	26,800	Dec. 16	1	[0·4]	Dec. 16
Côtes-du-Nord.	Plérin	5,346	Aug. 25	1	[1·9]	Aug. 25
	Saint Brieuc	19,948	Sept. 15	1	[0·5]	Sept. 15
Calvados	Honfleur	9,450	Aug. 28	8	8·5	Dec. 8
	Deauville	2,582	Sept. 3	14	55·3	Oct. 27
	Trouville	6,248	„ 7	14	22·4	„ 16
	Liseaux	16,260	„ 19	19	11·7	Nov. 15
	Touques	1,287	Oct. 2	1	[7·8]	Oct. 2
Corrèze	Roche-le-Peyroux	453	Aug. 30	1	[22·1]	Aug. 30
Orne	Rai	626	Aug. 30	1	[16·0]	Aug. 30
Hérault	Agde	7,389	Aug. 31	1	[1·3]	Aug. 31

TABLE A.—*continued.* APP. A. No.

Department.	Commune.	Population, Census 1891.	Date of first recorded Death from Cholera, 1892.	Total Deaths recorded from Cholera, 1892.	Cholera Death-rate per 10,000 Population.	Date of recorded Death Cholera 189
Morbihan	Faouët (Le)	3,277	Sept. 1	1	[3·1]	Sept.
	Caudan	7,670	„ 4	22	28·7	Dec.
	Plæmeur	12,413	Oct. 12	14	11·3	„
	Lorient	42,116	„ 25	101	24·0	„
	Riantec	5,717	Nov. 6	42	73·5	„
	Guéméné	1,865	„ 6	2	10·7	Nov.
	Hennebont	6,972	„ 12	14	20·1	Dec.
	Baud	4,768	„ 16	2	4·2	„
	Vannes	21,504	„ 25	1	[0·5]	Nov.
	Port-Louis	3,431	„ 27	12	35·0	Dec.
	Croix	4,935	Dec. 2	1	[2·0]	„
	Gavres	1,227	„ 2	7	57·1	„
	Inzinzac	3,436	„ 7	2	5·8	„
	Languidic	7,122	„ 12	1	[1·4]	„
	Palais (Le)	5,113	„ 15	1	[2·0]	„
Aisne	Lesdins	698	Sept. 2	1	[14·3]	Sept.
	Bourg-et-Comin	434	„ 4	1	[23·0]	„
	Saint-Quentin	47,551	„ 12	2	0·4	„
	Aulnois-sous-Laon	489	Oct. 21	2	40·9	Oct.
	Omissy	413	„ 28	4	96·8	Nov.
Aveyron	Flavin	1,496	Sept. 2	1	[6·7]	Sept.
	Asprières	1,201	„ 22	1	[8·3]	„
	Capdenac	3,265	„ 23	1	[3·1]	„
Manche	Margueray	273	Sept. 6	1	[36·6]	Sept.
	Tourlaville	7,382	„ 17	30	40·1	Dec.
	Cherbourg	38,554	„ 17	87	22·6	„
	Sauvemesnil	1,230	„ 27	2	16·2	Sept.
	Octeville	3,028	Oct. 3	5	16·5	Dec.
	Equeurdreville	5,421	Nov. 4	12	22·1	Nov.
	Gonneville	815	„ 20	1	[12·3]	„
	Auderville	455	Dec. 10	1	[22·0]	Dec.
Meuse	Jametz	565	Sept. 7	9	159·2	Oct.
Mayenne	St. Denis-de-Gastines	3,043	Sept. 8	1	[3·3]	Sept.
Haute-Savoie	Bluffy	174	Sept. 10	4	230·0	Sept.
Loire-Inférieure.	Nantes	122,730	Sept. 11	61	5·0	Dec.
	Chantenay-sur-Loire	14,139	Nov. 10	5	3·5	„
	Indre	3,517	„ 24	3	8·5	Nov.
	Doulon	5,521	„ 28	2	3·6	Dec.
	Coneron	5,377	Dec. 1	1	[1·9]	„
Vendée	Sables-d'Olonnes (Les)	11,557	Sept. 14	10	5·7	Oct.
Cher	Sancerre	3,853	Sept. 17	1	[2·6]	Sept.
	Ménétreol-sous-Sancerre	1,358	Nov. 6	1	[7·4]	Nov.
	Thauvenay	711	Dec. 3	1	[14·1]	Dec.

App. A. No. 12.

TABLE A.—*continued.*

Department.	Commune.	Population, Census 1891.	Date of first recorded Death from Cholera, 1892.	Total Deaths recorded from Cholera, 1892.	Cholera Death-rate per 10,000 Population.	Date of last recorded Death from Cholera, 1892.
	Portel (Le)	5,329	Sept. 17	59	*110·8*	Dec. 29
	Saint-Omer	21,661	„ 17	9	*4·2*	„ 23
	Boulogne-sur-Mer	45,305	„ 25	33	*7·3*	„ 2
	Calais	56,867	„ 28	25	*4·4*	„ 21
	Hinges	1,122	Oct. 1	2	*17·8*	Oct. 15
	Lapugnoy	1,677	„ 4	2	*11·9*	„ 26
	Auchel	7,262	„ 5	2	*2·8*	„ 28
	Outréau	3,862	„ 5	10	*25·9*	Dec. 16
	Dannes	628	„ 6	3	*47·8*	Oct. 17
	Lefaux	331	„ 7	3	*90·6*	„ 12
	Carvin	8,000	„ 7	2	*2·5*	„ 11
	Saint-Etienne	1,479	„ 10	6	*40·6*	„ 20
	Sangatte	2,025	„ 11	6	*29·6*	Nov. 18
	Guînes	4,502	„ 14	3	*6·7*	Dec. 1
	Sainte-Marie-Kerque	1,565	„ 14	2	*12·8*	Nov. 22
	Coudette	1,172	„ 16	1	[*8·5*]	Oct. 16
	Étaples	3,816	„ 21	43	*112·8*	Dec. 23
	Hesdin l'Abbé	582	„ 21	1	[*17·2*]	Oct. 21
	Tubersent	410	„ 30	4	*97·6*	Nov. 11
	Cormont	343	Nov. 2	1	[*29·2*]	„ 2
	Montreuil	3,603	„ 5	15	*41·7*	Dec. 28
	Frencq	908	„ 5	6	*66·1*	„ 30
	Saint-Josse	788	„ 13	1	[*12·7*]	Nov. 13
	Ardres	2,473	„ 19	5	*20·2*	Dec. 9
	Camiers	860	„ 19	2	*23·2*	Nov. 19
	Attaques (Les)	1,614	„ 20	3	*18·6*	Dec. 2
	Brêmes	881	„ 20	2	*22·7*	Nov. 21
	Hucqueliers	714	„ 20	3	*42·0*	Dec. 5
as-de-Calais	Berlinghem	349	„ 20	1	[*28·7*]	Nov. 20
	Coulogne	1,341	„ 21	1	[*7·5*]	„ 21
	Hesdin	3,409	„ 23	2	*5·9*	Dec. 7
	Cucq	829	„ 25	2	*24·1*	„ 6
	St.-Martin-Boulogne	4,669	„ 25	2	*4·3*	„ 11
	Preures	745	„ 27	11	*147·8*	„ 26
	Dohem	923	„ 28	1	[*10·8*]	Nov. 28
	Halinghem	458	Dec. 3	9	*196·5*	Dec. 25
	Courset	457	„ 3	1	[*21·9*]	„ 3
	Widehem	365	„ 4	1	[*27·4*]	„ 4
	Balinghem	567	„ 4	2	*35·3*	„ 5
	Saint-Aubin	175	„ 6	1	[*57·2*]	„ 6
	La Calotterie	489	„ 6	2	*40·9*	„ 7
	Bourthes	1,001	„ 6	2	*20·0*	„ 10
	Ecuires	632	„ 6	1	[*15·8*]	„ 6
	Brexent-Enocq	361	„ 8	1	[*27·7*]	„ 8
	Hubersent	373	„ 10	1	[*26·8*]	„ 10
	Inxent	294	„ 11	2	*68·0*	„ 14
	Beussent	691	„ 11	1	[*14·5*]	„ 11
	Beaurainville	1,325	„ 11	1	[*7·5*]	„ 11
	Halloy	467	„ 12	2	*42·8*	„ 21
	Enquin	168	„ 13	1	[*59·5*]	„ 13
	Neuville-sur-Mer	835	„ 13	1	[*12·0*]	„ 13
	Airon-Notre-Dame	255	„ 14	1	[*39·2*]	„ 14
	Nielles-lès-Bléquin	762	„ 14	3	*39·3*	„ 26
	Parenty	588	„ 17	3	*51·0*	„ 21
	Amplier	724	„ 18	4	*55·3*	„ 24
	Oye	2,379	„ 21	5	*21·0*	„ 31
	Neufchâtel	1,369	„ 29	1	[*7·3*]	„ 29

TABLE A.—*continued.* APP. A. No.

Department.	Commune.	Population, Census 1891.	Date of first recorded Death from Cholera, 1892.	Total Deaths recorded from Cholera, 1892.	Cholera Death-rate per 10,000 Population.	Date of record Death f Chole 1892
Loiret - -	Charmont - -	600	Sept. 22	1	[16·7]	Sept.
Puy-de-Dôme -	Thiers - -	16,814	Oct. 1	2	1·2	Oct.
Ardennes -	Rethel - -	7,136	„ 1	1	[1·4]	„
Drôme -	Séderon - -	629	„ 5	1	[15·9]	„
Doubs -	Besançon - -	56,055	„ 7	3	0·5	„
Gironde -	Saint-Christoly -	1,695	„ 16	1	[5·9]	„
Var - -	Solliès-Pont - -	2,705	„ 27	4	14·8	Nov.
Charente -	Courlac - -	233	Nov. 28	1	[42·9]	„
Maine-et-Loire	Combrée - -	1,935	Dec. 14	1	[5·2]	Dec.

TABLE B.

CHOLERA in BELGIUM from commencement of Epidemic *to October 12th*, 1892.

On the Origi and Progress the Western Diffusion of Cholera in 18 by Dr. Barry

Communes.	Date of First recorded Case of Cholera.	Population, Census 1890.	Total recorded Cholera.		Cholera Death-rate per 10,000 Population to Oct. 12, 1892.
			Cases.	Deaths.	
PROVINCE OF FLANDRE ORIENTALE.					
Aspelaere - -	July 20 -	1,223	1	—	—
Etichove - -	„ 28 -	2,356	1	1	[4·2]
Evergem - -	Aug. 21 -	6,948	1	1	[1·4]
Alost - - -	„ 23 -	25,544	15	4	1·6
Destelbergen - -	„ 23 -	3,925	2	—	—
Steendorp - -	„ 25 -	2,932	88	51	174·0
Burght - - -	„ 26 -	2,570	33	16	62·2
Gendbrugge - -	„ 27 -	8,262	3	3	3·6
Gand - - -	„ 27 -	148,729	7	5	0·3
Haesdonck - -	„ 28 -	2,742	1	—	—
Termonde - -	„ 28 -	9,606	2	2	2·1
Beveren-Waes -	„ 29 -	8,637	1	—	—
Zwyndrecht - -	„ 30 -	4,619	6	4	8·7
Rupelmonde - -	„ 31 -	3,182	5	2	6·3
Baesrode - -	Sept. 1 -	4,138	21	12	29·0
Assenede - -	„ 1 -	4,795	1	1	[2·1]
Basel - - -	„ 4 -	3,088	1	1	[3·2]
Melle - - -	„ 7 -	3,880	1	1	[2·6]
Moerbeke-Waes -	„ 8 -	5,345	11	8	15·0
Tamise - - -	„ 8 -	11,039	9	5	4·5
Herdersem - -	„ 21 -	1,483	3	3	20·2
Erpe - - -	„ 26 -	2,354	2	1	[4·3]
Grembergen - -	Oct. 5 -	2,662	1	1	[3·8]
Schoorisse - -	„ 9 -	2,389	3	—	—
Doel - - -	„ 11 -	2,330	1	1	[4·3]
			220	123	

TABLE B.—*continued.*

Communes.	Date of First recorded Case of Cholera.	Population, Census 1890.	Total recorded Cholera.		Cholera Death-rate per 10,000 Population to Oct. 12, 1892.
			Cases.	Deaths.	
PROVINCE OF FLANDRE OCCIDENTALE.					
Mouscron	July 26	13,764	1	1	[0·7]
Bruges	Aug. 31	47,497	2	1	[0·2]
Ooteghem	„ 31	1,813	1	1	[5·5]
Roulers	Sept. 2	20,339	1	1	[0·5]
Oedelem	„ 3	5,143	1	1	[1·9]
Gits	„ 5	3,220	3	2	6·2
Damme	„ 17	1,085	5	3	27·7
Snellegem	„ 18	1,147	1	1	[8·7]
Rumbeke	„ 21	5,768	1	1	[1·7]
Helchin	„ 22	1,276	1	1	[7·5]
			17	13	
PROVINCE OF HAINAUT.					
Jumet	Aug. 13	23,927	10	7	2·9
Roux	„ 19	8,430	2	—	—
Pecq	„ 23	1,990	2	1	[5·0]
Montigny-sur-Sambre	„ 24	15,479	1	1	[0·6]
Châtelineau-Gilly	„ 25	20,449	2	—	—
Châtelet	„ 29	11,176	5	—	—
Maubray	„ 29	1,536	1	1	[6·5]
Haine-St.-Pierre	„ 30	4,186	1	—	—
Nalinnes	„ 31	2,587	1	1	[3·9]
Strépy-Bracqueg	Sept. 1	5,070	2	2	3·9
Marchienne-au-Pont	„ 2	15,157	1	—	—
Charleroy	„ 2	20,668	1	1	[0·5]
Tournai	„ 5	34,442	1	1	[0·3]
Harchies	„ 10	1,541	1	1	[6·5]
Gozée	„ 11	1,579	1	1	[6·3]
Ath	„ 19	9,868	2	—	—
Flénu	„ 20	4,410	10	7	15·9
Pâturages	„ 20	10,789	40	21	19·5
Wasmes	„ 21	18,105	27	7	5·4
Quaregnon	„ 22	14,361	10	7	4·9
St. Ghislain	„ 23	3,759	5	4	10·6
Antoing	„ 26	2,673	1	1	[3·7]
Rouveroy	„ 26	509	1	1	[19·6]
Bruyelles	Oct. 1	1,092	1	—	—
Bandour	„ 2	3,837	2	2	5·2
Ghlin	„ 3	4,570	1	1	[2·2]
			132	68	

TABLE B.—*continued.*

Communes.	Date of First recorded Case of Cholera.	Population, Census 1890.	Total recorded Cholera.		Cholera Death-rate per 10,000 Population to Oct. 12, 1892.
			Cases.	Deaths.	
PROVINCE OF ANVERS.					
Anvers	Aug. 15	224,012	251	92	*4·1*
Niel	„ 26	6,020	76	39	*64·8*
Boom	„ 26	13,892	101	49	*35·3*
Hingene	„ 27	3,739	5	2	*5·3*
Rymenam	„ 28	2,239	1	—	—
Malines	„ 29	51,014	35	16	*3·1*
Santhoven	„ 29	1,107	1	—	—
Gheel	„ 30	12,026	1	—	—
Bornhem	„ 31	5,463	29	18	*33·0*
Willebroeck	Sept. 2	8,164	64	40	*49·0*
Eeckeren	„ 2	4,806	15	9	*18·7*
Hoboken	„ 3	6,987	4	4	*5·7*
Hemixem	„ 4	3,676	8	8	*21·7*
Herenthals	„ 4	6,007	5	4	*6·7*
Merxem	„ 5	8,453	13	7	*8·3*
Desschel	„ 5	2,099	3	2	*9·5*
Terhagen	„ 5	2,400	11	7	*29·2*
Wilryck	„ 5	5,495	1	1	[*1·8*]
Thisselt	„ 6	1,882	2	2	*10·6*
Austruweel	„ 10	604	5	2	*33·1*
Breendonck	„ 10	2,052	1	1	[*4·9*]
St. Amand	„ 12	2,647	3	3	*11·3*
Oelegehem	„ 13	1,382	1	1	[*7·2*]
Ranst	„ 14	1,627	1	—	—
Schelle	„ 15	2,020	1	—	—
Borgerhout	„ 15	28,882	11	7	*2·4*
Weert	„ 15	752	4	3	*39·9*
Hombeek	Sept. 16	2,095	1	—	—
Calmpthout	„ 20	3,625	1	1	[*2·8*]
Mariekerke	„ 25	1,222	3	2	*16·4*
Rumpst	„ 27	4,066	50	13	*32·0*
Lierre	„ 29	20,133	1	1	[*0·5*]
Ruysbroeck	Oct. 1	1,912	5	4	*20·9*
Blaesveldt	„ 1	1,295	1	—	—
			715	338	
PROVINCE OF LIÉGE.					
Liége	Aug. 24	147,660	2	1	[*0·1*]
Fléron	Sept. 16	2,122	1	1	[*4·7*]
Cheratte	„ 25	2,531	1	1	[*3·9*]
Seilles	Oct. 8	2,825	1	—	—
			5	3	

TABLE B.—*continued.*

Communes.	Date of First recorded Case of Cholera.	Population, Census 1890.	Total recorded Cholera.		Cholera Death-rate per 10,000 Population to Oct. 12, 1892.
			Cases.	Deaths.	
PROVINCE OF BRABANT.					
Dilbeek - - -	Aug. 25 -	2,195	1	—	—
Uccle - - -	„ 26 -	13,400	1	—	—
Schaerbeek - -	„ 29 -	50,826	1	1	[0·2]
Molenbeek St. Jean -	Sept. 1 -	48,723	50	43	8·8
Bruxelles - -	„ 3 -	176,138	6	5	0·3
Glimes - - -	„ 3 -	661	1	1	[15·1]
Etterbeek - -	„ 4 -	17,735	2	2	1·1
Vilvorde - -	„ 8 -	11,138	3	3	2·7
Sichem - - -	„ 14 -	2,807	2	—	—
Anderlecht - -	„ 18 -	32,311	20	13	4·0
St.-Gilles - -	„ 21 -	40,289	1	—	—
Lixdekerke - -	„ 23 -	3,250	9	3	9·2
Ixelles - - -	„ 24 -	44,497	1	—	—
Biez - - -	„ 28 -	624	1	—	—
Hal - - -	„ 30 -	10,441	1	1	[0·9]
Overyssche - -	Oct. 1 -	5,830	3	1	[1·7]
Erps-Querbs - -	„ 6 -	2,206	1	1	[4·5]
Londerzeel - -	„ 11 -	4,707	1	—	—
			105	75	
PROVINCE OF LIMBOURG.					
Diepenbeek - -	Sept. 2 -	3,642	1	1	[2·7]
Quaedmechelen - -	„ 20 -	1,342	1	1	[7·6]
Borloo - - -	„ 25 -	561	1	1	[17·8]
Looz-la-ville - -	Oct. 10 -	2,349	1	—	—
			4	3	
PROVINCE OF NAMUR.					
Vierves - - -	Sept. 8 -	799	1	—	—
Andenne - -	„ 30 -	7,075	1	—	—
			2	—	
PROVINCE OF LUXEMBOURG.					
Meix-devant-Virton -	Sept. 11 -	872	7	3	3·

TABLE C.

CHOLERA in the GERMAN EMPIRE from the COMMENCEMENT of the EPIDEMIC *to November 19th*, 1892.

County (Kreis) or County Town (Stadt Kreis).	Place.	Date of first recorded Case of Cholera.	Population, Census 1890.	Cholera.		Cholera Death-rate per 10,000 Population to Nov. 19th 1892.
				Cases.	Deaths.	
STATES OF HAMBURG:						
Hamburg -	Hamburg - -	Aug. 16	622,530	16,956	8,605	*138·2*
	PRUSSIA.					
GOVERNMENT DISTRICT OF SCHLESWIG:						
Altona (town) -	Altona (town) -	Aug. 19	143,249	572	328	*22·9*
Lauenburg -	Lauenburg -	Aug. 21	5,101	43	25	*49·0*
	Havekost - -	„ 26	181	1	1	[*55·2*]
	Breitenfelde -	„ 27	690	1	—	—
	Schiphorst -	„ 29	374	1	—	—
	Ratzeburg -	Sept. 1	4,223	2	2	*4·7*
Pinneberg -	Utersen - -	Aug. 23	5,311	7	3	*5·7*
	Langenfelde - Stellingen.	„ 23	3,096	6	2	*6·5*
	Pinneberg -	„ 26	3,777	4	3	*7·9*
	Elmshorn - -	„ 26	9,803	6	3	*3·1*
	Blankenese -	„ 26	3,922	8	7	*17·8*
	Lockstedt -	„ 26	2,700	8	5	*18·5*
	Heidgraben -	„ 27	444	1	—	—
	Rellingen - -	„ 31	1,061	1	—	—
	Scholenfleth -	„ 31	1,212	1	—	—
	Schulau - -	„ 31	361	3	2	*55·3*
	Osdorf - -	„ 31	915	1	—	—
	Geestermühe -	Sept. 1	706	3	1	[*14·2*]
	Neuendeich -	„ 1	544	1	—	—
	Garstedt - -	„ 1	1,242	2	1	[*8·0*]
	Nienstedten -	„ 2	1,206	2	1	[*8·3*]
	Haselau - -	„ 2	853	1	—	—
	Moorrege - -	„ 2	1,194	1	—	—
	Tangstedt - -	„ 2	645	1	—	—
	Kl. Flottbek -	„ 3	1,015	3	2	*19·7*
	Kummerfeld -	„ 6	421	1	—	—
	Kölln - -	„ 8	195	1	1	[*51·3*]
	Raa-Besenbek -	„ 9	381	2	—	—
	Lutzhorn - -	Oct. 5	575	1	—	—
Kiel (town) -	Kiel (town) -	Aug. 25	69,172	21	11	*1·6*
Rendsburg -	Elsdorf - -	Aug. 25	886	1	1	[*53·7*]
	Schülp - -	„ 25	366	1	—	—
	Rendsburg -	„ 28	13,195	15	11	*8·3*
Norderdithmarschen.	Hemme - -	Aug. 25	1,114	1	1	[*9·0*]
Stormarn (part of).	Wandsbeck -	Aug. 25	20,571	64	43	*20·9*
	Schiffbek - -	„ 26	3,201	11	1	[*3·1*]
	Poppenbüttel -	„ 26	586	2	2	*34·1*
	Harkesheide -	„ 26	500	1	1	[*20·0*]
	Hinschenfelde -	„ 27	2,070	10	9	*43·5*
	Rethwischfeld -	„ 28	454	1	1	[*18·1*]

App. A. No. 12. TABLE C.—*continued.*

County (Kreis) or County Town (Stadt Kreis).	Place.	Date of first recorded Case of Cholera.	Population, Census 1890.	Cholera		Cholera Death-rate per 10,000 Population to Nov. 19th, 1892.
				Cases.	Deaths.	
GOVERNMENT DISTRICT OF SCHLESWIG—*cont.*						
Stormarn (part of)—*cont.*	Grabau	Aug. 28	179	1	1	[56·0]
	Hummelsbüttel	„ 29	512	3	—	—
	Havighorst	„ 30	420	1	—	—
	Bramfeld	„ 31	1,169	2	—	—
	Ahrensburg	„ 31	1,625	1	1	[6·2]
	Sasel	„ 31	502	2	1	[19·9]
	Glinde	„ 31	281	3	3	106·8
	Wulfsdorf	Sept. 1	217	1	1	[46·0]
	Steinbek	„ 1	1,472	1	1	[6·8]
	Oldenfelde	„ 4	320	1	1	[31·2]
	Oejendorf	„ 4	418	1	—	—
	Tangstedterheide	„ 8	807	5	3	37·2
Kiel	Suchsdorf	Aug. 28	911	*	*	*
	Neumünster	„ 30	17,539	1	—	—
	Schierensee	Sept. 1	169	1	1	
	Bollhuserteich	„ 2		1	1	?
	Ottendorf	„ 8	401	1	1	[24·9]
Husum	Arlewatt (Olderup)	Aug. 29	466	1	—	—
Oldenburg	Brodau	Aug. 29	823	1	1	[12·2]
Steinburg	Lockstedter Camp	Aug. 29	480	10	5	104·1
	Lockstedt	„ 30	176	1	—	—
	Blomesche Wildnisz.	„ 30	685	1	—	—
	Beidenfleth	„ 31	946	1	1	[10·6]
	Neuendorf	Sept. 1	927	2	1	[10·8]
	Münsterdorf	„ 4	687	2	1	[14·5]
	Wewelsfleth	„ 5	1,242	3	1	[8·0]
	Rethwisch	„ 5	376	3	3	79·8
	Itzehoe	„ 9	12,481	1	1	[0·8]
chleswig	Kappeln	Aug. 30	2,492	1	—	—
	Schleswig	Sept. 4	15,123	1	1	[0·7]
	Erfde	„ 4	1,469	1	—	—
Plön	Plön	Aug. 31	3,212	1	—	—
Eiderstedt	Tönning	Sept. 2	3,228	1	1	[3·1]
Tondern	Amrum Island	Sept. 2	670	1	—	—
Segeberg	Segeberg	Sept. 4	4,552	1	—	—
	Sülfeld	„ 8	569	3	2	35·1
Süderdithmarschen.	Meldorf	Sept. 11	3,377	1	—	—
GOVERNMENT DISTRICT OF LÜNEBURG:						
Harburg	Altenwerder	Aug. 21	1,945	16	10	51·5
	Wilhelmsburg	„ 22	8,766	116	61	69·7
	Ehestorf	„ 24	145	1	1	[69·0]
	Finkenwerder	„ 25	755	6	3	39·7
	Neuhof	„ 26	900	7	3	33·3
	Lauenbruch	„ 29	745	3	3	40·3

* Six cases removed from Suchsdorf to Kiel

TABLE C.—*continued.* APP. A. No. 12.

County (Kreis) or County Town (Stadt Kreis).	Place.	Date of first recorded Case of Cholera.	Population, Census 1890.	Cholera		Cholera Death-rate per 10,000 Population to Nov. 19th, 1892.
				Cases.	Deaths.	
GOVERNMENT DISTRICT OF LÜNEBURG—*cont.*						
Harburg—*cont.*	Over	Aug. 29	658	2	1	[15·2]
	Eckel	„ 30	127	1	1	[78·7]
	Neuland	„ 31	677	5	3	44·3
	Bullenhausen	Sept. 1	261	2	2	76·5
	Immenbeck	„ 3	299	1	—	—
	Friesenwerdermoor	„ 16	136	1	1	[73·5]
Uelzen	Uelzen	Aug. 24	7,700	4	1	[1·3]
Winsen	Winsen	Aug. 25	3,367	3	2	5·9
	Fahrenholz	Sept. 15	135	1	1	[73·5]
	Achterdeich	„ 15	156	1	—	—
Lüneburg	Barförde	Aug. 27	184	1	1	[54·3]
	Artlenburg	„ 30	459	3	2	43·6
Harburg (town)	Harburg (town)	Aug. 27	34,835	22	13	3·7
Bleckede	Gosewerder	Aug. 29	55	1	1	[182·0]
	Kleinburg - Burglehn.	Sept. 2	452	1	1	[22·1]
Dannenberg	Drethem	Aug. 31	155	2	2	129·0
	Tiesmesland	Sept. 3	102	2	2	196·0
	Schutschur	„ 12	130	1	1	[77·0]
Burgdorf	Burgdorf	Sept. 4	3,386	1	—	—
GOVERNMENT DISTRICT OF STADE:						
Kehdingen	Assel	Aug. 24	2,949	4	3	10·2
	Hamelvörden	„ 28	1,771	6	3	16·9
	Freiburg	„ 30	2,278	2	—	—
	Bützfleth	„ 30	2,331	14	9	38·6
	Neuland	Sept. 2	1,235	6	4	32·6
	Krautsand	„ 4	1,155	12	7	60·6
	Drochtersen	„ 5	3,756	9	5	13·3
Jork	Moorende	Aug. 25	645	4	1	[15·5]
	Cranz	„ 25	536	1	1	[18·7]
	Estebrügge	„ 25	759	11	7	92·2
	Neuenfelde	„ 25	1,829	43	21	114·8
	Hove	„ 26	477	4	1	[21·0]
	Königreich	„ 26	770	6	5	64·9
	Buxtehude	„ 27	3,443	1	1	[2·9]
	Francop	„ 31	678	4	1	[14·7]
	Ladecop	„ 31	629	1	—	—
	Borstel	Sept. 1	1,906	8	—	—
	Twielenfleth	„ 2	1,102	1	1	[9·1]
	Jork	„ 4	1,370	3	2	14·6
	Steinkirchen	„ 19	1,176	1	1	[8·5]
	Mittelnkirchen	„ 29	870	2	2	23·0
Rotenburg	Rotenburg	Aug. 28	2,338	1	1	[4·2]
Neuhaus am Oder.	Hechthausen	Aug. 30	715	1	1	[14·0]
	Neuhaus	Sept. 3	1,655	1	1	[6·0]
	Belum	„ 6	659	3	—	—
	Hüll	Oct. 3	1,023	1	1	[9·8]

App. A. No. 12. TABLE C.—*continued.*

County (Kreis) or County Town (Stadt Kreis).	Place.	Date of first recorded Case of Cholera.	Population, Census 1890.	Cholera		Cholera Death-rate per 10,000 Population to Nov. 19th, 1893.
				Cases.	Deaths.	
GOVERNMENT DISTRICT OF STADE—*cont.*						
Stade	Stade	Aug. 31	10,191	5	3	2·9
	Nottensdorf	Sept. 4	343	2	—	—
	Blidersdorf	„ 18	513	1	1	[19·5]
	Stadersand	„ 20	93	1	1	[107·0]
Achim	Achim	Sept. 18	2,820	5	4	14·2
GOVERNMENT DISTRICT OF POTSDAM:						
Westprignitz	Wittenberge	Aug. 25	12,590	21	8	6·4
	Mödlich	Sept. 2	498	1	1	[20·1]
	Bälow	„ 2	270	1	1	[37·1]
	Cumlosen	„ 3	603	3	3	49·8
	Lenzen	„ 5	2,768	1	1	[3·6]
	Motrich	„ 13	350	1	—	—
Charlottenburg (town).	Charlottenburg (town).	Aug. 30	76,518	8	5	0·6
Westhavelland	Rathenow	Sept. 1	16,353	6	3	1·8
	Plauer lock	„ 27	—	1	1	[?]
Templin	Zehdenik	Sept. 2	3,390	1	1	[2·9]
Niederbarnim	Neu Weiszensee	Sept. 2	18,015	1	—	—
	Zerpenschleuse	„ 9	1,816	1	1	[5·5]
	Malzer lock	„ 28	—	1	1	[?]
	Liebenwalde (Finow Canal.	Oct. 2	—	1	1	[?]
	Nieder-Schönhausen (in the forest).	„ 2	—	1	1	[?]
	Rummelsburg (workhouse).	„ 5	—	*	—	—
Spandau (town)	Spandau (town)	Sept. 9	44,495	2	2	0·4
Overbarnim	Eberswalde	Sept. 11	16,122	5	4	2·5
	Hegermühle	„ 17	2,377	2	2	8·4
Angermünde	Schwedt	Sept. 15	9,756	1	1	[1·0]
	Hohensaathen	„ 21	955	2	2	20·9
	Boat in Oderberger Lake.	Oct. 1	—	1	1	[?]
Osthavelland	Boat at Pichelswerder.	Oct. 1	—	1	1	[?]
GOVERNMENT DISTRICT OF OSNABRÜCK:						
Osnabrück	Osnabrück	Aug. 25	39,929	1	1	[0·2]
Iburg	Dissen	Aug. 27	1,646	1	1	[6·1]

* Two cases removed from Rummelsburg Workhouse to Berlin.

TABLE C.—*continued.* APP. A. No. 12.

County (Kreis) or County Town (Stadt Kreis).	Place.	Date of first recorded Case of Cholera.	Population, Census 1890.	Cholera		Cholera Death-rate per 10,000 Population to Nov. 19th, 1892.
				Cases.	Deaths.	
GOVERNMENT DISTRICT OF MAGDEBURG:						
Salzwedel -	Perver - -	Aug. 26	1,070	1	1	[9·3]
Magdeburg (town)	Magdeburg (town)	Aug. 28	202,234	11	6	9·3
Wolmirstedt -	Rogätz - -	Aug. 30	1,986	1	—	—
Kalbe - -	Glinde - -	Aug. 31	384	1	—	—
	Aken - -	Sept. 2	6,109	1	1	[1·6]
Jerichow II. -	Schollene - -	Sept. 2	1,205	1	1	[8·3]
	Woltersdorf -	„ 11	371	1	1	[27·0]
	Gross-Wusterwitz	„ 18	1,173	2	2	17·0
Wanzleben -	Westerhüsen -	Sept. 10	2,595	1	1	[3·9]
	Fermersleben -	Oct. 16	2,572	2	1	[3·9]
Stendal - -	Carlbau near Tangermünde.	Sept. 22	76	2	2	293·0
GOVERNMENT DISTRICT OF OPPELN:						
Gross Strehlitz -	Suchau - -	Aug. 27	418	2	1	[23·9]
Leobschutz -	Deutsch Neukirch	Aug. 27	1,152	1	—	—
GOVERNMENT DISTRICT OF POSEN:						
Krotoschin -	Ruda - -	Aug. 28	325	1	1	[30·8]
CITY OF BERLIN:						
Berlin - -	Berlin - -	Aug. 29	1,579,244	32	15	0·1
GOVERNMENT DISTRICT OF KOBLENZ:						
Koblenz (town) -	Koblenz (town) -	Aug. 29	32,671	5	3	0·9
St. Goar - -	St. Goar - -	Sept. 27	1,469	1	1	[6·8]
Mayen - -	Miesenheim -	Sept. 28	1,075	9	6	55·8
	Polch -	Oct. 14	2,674	2	—	—
	Plaidt - -	„ 16	1,509	7	2	13·2
Koblenz - -	Benndorf - -	Oct. 17	5,017	1	—	—
GOVERNMENT DISTRICT OF HILDESHEIM:						
Marienburg in Hannover.	Moritzberg -	Aug. 30	2,000	2	2	10·0
Hildesheim -	Hildesheim -	Aug. 31	33,481	2	1	[0·3]
Zellerfeld -	Zellerfeld - -	Sept. 1	4,400	1	1	[2·3]
GOVERNMENT DISTRICT OF STRALSUND:						
Greifswald -	Greifswald -	Aug. 31	21,624	1	1	[0·5]
	Wolgast - -	Sept. 10	7,889	1	1	[1·3]
Stralsund (town)	Stralsund (town) -	Oct. 6	28,984	1	1	[0·3]

App. A. No. 12. TABLE C.—*continued.*

County (Kreis) or County Town (Stadt Kreis).	Place.	Date of first recorded Case of Cholera.	Population, Census 1890.	Cholera		Cholera Death-rate per 10,000 Population to Nov. 19th, 1892.
				Cases.	Deaths.	
GOVERNMENT DISTRICT OF KÖSLIN:						
Stolp	Stolpmünde	Sept. 2	1,957	1	—	—
GOVERNMENT DISTRICT OF MINDEN:						
Bielefeld	Bielefeld	Sept. 2	39,950	1	—	—
GOVERNMENT DISTRICT OF STETTIN:						
Naugard	Lübzin	Sept. 3	1,765	6	2	*11·3*
Randow	Grabow on Oder	Sept. 5	15,703	1	—	—
	Stolzenhagen	„ 12	2,027	6	6	*29·6*
	Kratzwiek*	„ 18	278	—	—	—
	Züllchow	„ 18	6,788	5	4	*5·8*
	Frauendorf*	„ 19	2,741	—	—	—
	Glienken*	„ 21	383	3	2	*52·2*
	Schillersdorf	„ 22	393	3	2	*50·9*
	Gartz on Oder	„ 29	4,431	2	—	—
	Pölitz	„ 29	3,905	1	1	[*2·6*]
Stettin (town)	Stettin (town)	Sept. 8	116,228	28	17	*1·5*
Ueckermünde	Ueckermünde	Sept. 13	6,112	12	11	*18·0*
	Ziegenort	„ 17	1,986	4	3	*15·1*
	Torgelower Holländerei.	„ 18	500	7	3	*60·0*
	Tolgelow	„ 19	3,029	1	1	[*3·3*]
Greifenhagen	Fiddichow	Sept. 23	2,709	1	1	[*3·7*]
	Pakulent	Oct. 1	460	1	1	[*21·7*]
Greifenberg	Schwessow	Sept. 22	337	1	1	[*29·7*]
Saatzig	Stargard (in Pomerania).	Oct. 2	23,785	1	1	[*0·4*]
Usedom-Wollin	Swinemünde	Oct. 4	8,510	1	1	[*1·2*]
Demmin	Demmin	Oct. 7	10,886	3	3	*2·8*
GOVERNMENT DISTRICT OF HANNOVER:						
Hannover (town)	Hannover (town)	Sept. 3	163,593	2	1	[*0·05*]
Syke	Kirchweyhe	Sept. 4	1,145	2	—	—
Hoya	Bruchhausen	Sept. 22	2,126	3	—	—
GOVERNMENT DISTRICT OF DUSSELDORF:						
Kleve	Kleve	Sept. 5	10,407	1	1	[*0·9*]
Krefeld (town)	Krefeld (town)	Sept. 14	105,371	1	—	—
Duisburg (town)	Duisburg (town)	Sept. 24	59,300	1	1	[*0·2*]

* One case removed from Kratzwiek, one from Frauendorf, and two from Glienken and Züllchow.

TABLE C.—*continued.* APP. A. No. 12.

County (Kreis) or County Town (Stadt Kreis).	Place.	Date of first recorded Case of Cholera.	Population, Census 1890.	Cholera		Cholera Death-rate per 10,000 Population to Nov. 19th, 1892.
				Cases.	Deaths.	
GOVERNMENT DISTRICT OF BROMBERG:						
Kolmar in Posen	Schneidemühl	Sept. 9	14,447	1	—	—
GOVERNMENT DISTRICT OF FRANKFURT:						
Landsberg (town)	Landsberg (town)	Sept. 17	28,065	1	1	[0·4]
Frankfurt on Oder (town.)	Frankfurt on Oder (town.)	Sept. 20	55,726	1	—	—
Königsberg in Neumark	Oderberg (fortress)	Sept. 25	60	1	1	[167·0]
	Niederwutzow	Oct. 3	550	4	4	73·0
	Hohenwutzen	„ 4	929	2	2	21·5
	Küstrin	„ 5	16,666	1	1	[0·6]
Lebus	Fürstenwalde	Oct. 5	12,934	1	—	—
GOVERNMENT DISTRICT OF AURICH:						
Wittmund	Wilhelmshaven	Sept. 19	15,630	1	—	—
GOVERNMENT DISTRICT OF WIESBADEN:						
Frankfurt on Main (town).	Frankfurt on Main (town).	Oct. 7	179,850	3	3	0·2
GOVERNMENT DISTRICT OF MARIENWERDER:						
Thorn	Schilno	Oct. 15	406	2	2	49·2
	Thorn	„ 19	27,018	2	2	0·7
Kulm	Kulm	Oct. 18	9,762	1	—	—
	Kiewo	Nov. 6	360	8	1	[27·8]
Stuhm	Rothof	Oct. 30	40	1	1	[250·0]
Marienwerder	Kurzebrack	Nov. 9	—	1	1	[?]
MECKLENBURG SCHWERIN.						
Ludwigslust	Neustadt	Aug. 25	1,743	2	—	—
	Wendisch-Wehningen.	„ 27	284	5	—	—
	Alt Krenzlin	„ 27	373	7	2	53·6
	Ludwigslust	„ 30	6,500	2	1	[1·5]
	Dömitz	Sept. 1	2,611	6	6	23·0
Boizenburg	Boizenburg with Altendorf.	Aug. 26	3,829	38	19	49·6
	Loosen	„ 27	523	1	1	[19·1]
	Neugülze	„ 29	222	1	—	—
	Gr. Krams	Sept. 3	563	1	1	[17·8]
	Vorderhagen	„ 24	271	1	1	[36·9]
Rostock	Rostock	Aug. 27	44,409	4	2	0·45
Bützow	Doberan	Aug. 28	4,849	1	—	—
	Brüel	Sept. 2	2,103	2	1	[4·8]
	Bützow	„ 3	5,256	1	—	—
Malchin	Malchin	Aug. 30	7,298	3	3	4·1
Wismar	Wismar	Sept. 2	16,787	3	2	1·2

APP. A. No. 12. TABLE C.—*continued.*

County (Kreis) or County Town (Stadt Kreis).	Place.	Date of first recorded Case of Cholera.	Population, Census 1890.	Cholera		Cholera Death-rate per 10,000 Population to Nov. 19th, 1892.
				Cases.	Deaths.	
	MECKLENBURG SCHWERIN—*cont.*					
Gnoien - -	Tessin - -	Sept. 2	2,474	3	2	*8·1*
Güstrow - -	Güstrow - -	Sept. 3	14,568	1	—	—
Gadebusch -	Rehna - -	Sept. 13	2,151	1	1	[*4·6*]
	KINGDOM OF SAXONY.					
Leipzig - -	Leipzig - -	Aug. 26	354,899	2	1	[*0·03*]
Flöha - -	Auerswalde -	Oct. 23	1,833	5	3	*16·4*
	MECKLENBURG STRELITZ.					
Schönberg -	Schönberg -	Aug. 26	2,846	3	2	*7·0*
Neustrelitz -	Priepert - -	Aug. 27	4,001	1	1	[*2·5*]
	Wesenberg -	Sept. 1	1,621	2	2	*12·3*
	Canow - -	„ 4	167	1	1	[*60·0*]
Neubrandenburg	Neubrandenburg -	Aug. 30	9,323	5	—	—
	OLDENBURG.					
Delmenhorst -	Delmenhorst -	Aug. 26	6,828	1	1	[*1·5*]
Lübeck	Niendorf - -	Sept. 3	451	2	—	—
	SACHSEN ALTENBURG.					
Ostkreis - -	Rositz - -	Aug. 28	1,106	1	1	[*9·0*]
	BREMEN.					
	Bremen - -	Aug. 28	125,684	6	6	*0·5*
	Bremerhaven -	„ 29	16,414	1	1	[*0·6*]
	BRAUNSCHWEIG.					
Helmstedt -	Jerxheim - -	Aug. 31	1,866	1	1	[*5·4*]
	LÜBECK.					
	Lübeck - -	Aug. 31	63,590	6	3	*0·5*
	SACHSEN WEIMAR.					
Weimar - -	Weimar - -	Sept. 11	24,546	1	—	—
	HESSEN.					
Bingen - -	Bingen -	Oct. 7	7,654	1	—	—
	BADEN.					
Karlsruhe -	Leopoldshaven -	Oct. 10	728	1	1	[*13·7*]
	ANHALT.					
Zerbst - -	Roszlau - -	Oct. 10	7,628	1	1	[*1·3*]

Table D.

Cholera in Holland in 1892.

Province.	Commune.	Population (Census 1889).	Total Deaths recorded as due to Cholera, 1892.	Cholera Death-rate per 10,000 of the Population, 1892.
Noordbrabant	Breda	22,176	9	4·1
	Drunen	2,895	1	[3·5]
	Empel en Meerwijk	586	1	[17·1]
	's Hertogenbosch	27,138	3	1·1
	Heusden	2,024	2	9·9
	Mill en St. Hubert	2,381	1	[4·2]
	Oud-en Nieuw-Gastel	4,376	2	4·6
	Prinsenhage	7,153	2	2·8
	Steenbergen	6,838	1	[1·5]
	Terheijden	3,258	2	6·1
			24	
Gelderland	Appeltern	3,032	1	[3·3]
	Brakel	1,314	1	[7·6]
	Drumpt (Wadenoijen)	1,518	1	[6·6]
	Huissen	4,074	5	12·3
	Maurik	3,703	1	[2·7]
	Millingen	2,676	1	[3·7]
	Nijmegen	32,101	1	[0·3]
	Varik	1,106	3	27·1
	Vuren	1,507	1	[6·6]
	Zuilichem	890	2	22·5
			17	
Zuidholland (part of).	Alblasserdam	4,716	2	4·2
	Alphen	4,232	4	9·4
	Barwoutswaarder	849	2	2·3
	Beijerland (Zuid-)	1,998	2	10·0
	Bergambacht	2,908	1	[3·4]
	Bleskensgraaf	976	7	71·8
	Bodegraven	3,755	2	5·3
	Boskoop	2,806	3	10·7
	Brandwijk	838	1	[11·9]
	Capelle aan den IJssel	3,311	7	21·1
	Charlois	9,706	5	5·2
	Delft	28,458	2	0·7
	Gorinchem	11,879	3	2·5
	Gouda	19,704	7	3·6
	Goudswaard	1,175	4	34·1
	's Gravendeel	3,965	1	[2·5]
	's Gravenhage	156,809	5	0·3
	's Gravenzande	5,048	5	9·9
	Hazerswoude	3,339	7	21·0
	Hendrik-Ido-Ambacht	2,955	4	13·5
	Koudekerk	1,468	4	27·2
	Kralingen	16,677	3	1·8
	Krimpen aan den IJssel	2,197	1	[4·6]
	Maasland	2,648	1	[3·8]
	Maasluis	6,455	3	4·7

TABLE D.—*continued.*

Province.	Commune.	Population (Census 1889).	Total Deaths recorded as due to Cholera, 1892.	Cholera Death-rate per 10,000 of the Population, 1892.
Zuidholland (part of)—*cont.*	Nieuwerkerk aan den IJssel.	2,372	1	[4·2]
	Numansdorp - -	3,207	1	[3·1]
	Oostvoorne - -	1,802	3	16·7
	Oudewater - -	2,706	1	[3·7]
	Oudshoorn - -	2,222	1	[4·5]
	Puttershoek - -	2,028	2	9·9
	Reeuwijk - -	2,909	1	[3·4]
	Rietveld - -	592	3	50·6
	Rotterdam - -	201,858	22	1·1
	Sliedrecht - -	9,892	1	[1·0]
	Wateringen - -	1,822	1	[5·5]
	Woerden - -	4,672	3	6·4
	Woubrugge - -	2,069	1	[4·8]
	Zwammerdam - -	1,625	3	18·5
	Zwijndrecht - -	5,100	4	7·8
			134	
Noordholland	Amsterdam - -	408,061	10	0·2
	Haarlem -	50,500	2	0·4
	Nederhorst den Berg -	1,186	4	33·7
	Velsen - -	6,775	1	[1·5]
	Weesp - -	5,208	2	3·8
	Zaandam - -	15,282	1	[0·7]
			20	
Zeeland - -	Brouwershaven -	1,453	1	[6·9]
	Kruiningen - -	2,964	1	[3·4]
	Veere - - -	806	1	[12·4]
			3	
Utrecht - -	Breukelen-Nijenrode -	2,323	6	25·8
	Jutphaas - -	2,629	6	22·8
	Loosdrecht - -	3,309	3	9·1
	Maarssen - -	2,066	7	33·9
	Maarsseveen - -	1,416	2	14·1
	Utrecht - -	84,346	35	4·2
	IJsselstein - -	3,467	17	49·0
	Zuilen - - -	1,060	2	18·9
			78	
Friesland - -	Leeuwarden -	30,433	2	0·7
	Menaldumadeel (Berlicum).	10,425	1	[0·9]
	Sneek - - -	11,469	1	[0·8]
	Utingeradeel - -	5,089	1	[1·9]
			5	

TABLE D.—*continued.*

Province.	Commune.	Population (Census 1889).	Total Deaths recorded as due to Cholera, 1892.	Cholera Death-rate per 10,000 of the Population, 1892.
Overijssel -	Diepenveen - -	3,860	2	*5·2*
	Kampen - -	18,687	1	[*0·5*]
			3	
Groningen -	Groningen - -	56,038	4	*0·7*
	Hoogezand - -	8,661	1	[*1·2*]
	Loppersum - -	2,784	1	[*3·6*]
			6	
Drenthe - -	Zuidwolde - -	3,365	1	[*3·0*]
Limburg - -	Meerssen - -	3,919	1	[*2·5*]

TABLE E.

CHOLERA in the AUSTRIA-HUNGARIAN EMPIRE in 1892.

(1.) AUSTRIA.

Province.	Department.	Town or Village.	Date of first recorded case of Cholera.	Population.	Total recorded Cholera		Cholera Death-rate per 10,000 of the Population, 1892.
					Attacks.	Deaths.	
Galizien -	Wielczka -	Podgorze - -	Sept. 8th	13,144	18	16	*12·2*
		Debriki - -	Oct. 2nd	902	6	3	*33·3*
		Plaszow - -	„ 2nd	1,119	5	5	*44·7*
		Luzina - -	„ 5th	526	1	1	[*19·0*]
		Ludwinow -	„ 6th	637	2	2	*31·4*
		Piaski-wielkie -	„ 12th	1,324	34	13	*98·2*
		Tyniec - -	„ 12th	1,122	8	5	*44·6*
		Prokocim - -	„ 25th	683	3	1	[*14·6*]
		Dobczyce - -	„ 26th	3,391	4	3	*8·8*
		Rzaka - -	„ 31st	381	1	—	*0·0*

TABLE E.—*continued.*

Province.	Department.	Town or Village.	Date of first recorded case of Cholera.	Population.	Total recorded Cholera		Cholera Death-rate per 10,000 of the Population, 1892.
					Attacks.	Deaths.	
Galizien—*cont.*	Krakau (city)	Krakau (city)	Sept. 11th	74,573	42	23	3·4
	Gorlice	Wolowiec	„ 12th	694	4	2	28·8
	Krakau (district)	Koscielniki	Oct. 1st	1,008	2	1	[9·9]
		Zwierzyniec	„ 2nd	2,779	3	3	10·8
		Dabie	„ 6th	737	2	1	[13·5]
		Ujazd	„ 8th	153	1	1	[65·4]
		Grzegorski	„ 17th	2,100	1	1	[4·8]
		Russocice	„ 18th	910	1	1	[11·0]
	Bochnia	Niepolomice	„ 2nd	4,207	9	4	9·5
	Mielec	Zachwiejow	Nov. 2nd	160	1	1	[62·5]
	Nisko	Dabrowka	„ 4th	680	1	1	[14·7]
	Husiatyn	Husiatyn	„ 14th	6,291	6	5	7·9
		Olchowczyk	„ 15th	1,231	8	5	40·6
		Szydlowce	„ 20th	1,206	19	8	66·3
		Suchodol (Bednarowka).	„ 23rd	1,048	3	1	[9·5]
		Czarnokoncewielkie.	Dec. 3rd	2,906	1	—	0·0
		Kociubinczyki	„ 7th	1,445	1	1	[6·9]
		Siekierczynce	„ 23rd	827	3	1	[12·1]
		Zielona	„ 24th	712	1	1	[14·0]
		Sidorow	„ 25th	2,010	1	—	0·0
	Borszczow	Zalucze	„ 22nd	652	13	7	107·4
		Wierzbowka	„ 23rd	562	2	2	35·7
Böhmen	Pisek	Wrabsko	Oct. 15th	?	1	1	[?]
Steiermark	Pettau	Sabotzen	„ 15th	?	2	2	?
Nieder Oesterreich.	Wien (city)	Wien (Vienna)	„ 21st	1,364,548	4	3	0·02

Table E.—*continued.*

(2.) Hungary.

County. (Date of Invasion given in Brackets [ ].)	Town or Village. (Municipal Towns printed in Small Capitals.)	Population.	Total recorded Cholera		Cholera Death-rate per 10,000 Population 1892.
			Attacks.	Deaths.	
[September 26]	BUDAPEST	491,938	889	473	*9·6*
Tolna [October 2.]	Tolna	7,840	8	5	*6·4*
	Dunaföldvár	12,364	6	4	*3·2*
	Ócsény	3,734	1	1	[*2·7*]
	Paks	11,803	10	6	*5·1*
	Szegzárd	14,325	3	2	*1·4*
	Báttaszék	8,153	2	2	*2·5*
	Gerjen	1,698	3	2	*11·8*
	Dombori	?	1	1	[?]
Fejér [October 3.]	Bicske	6,037	2	2	*3·3*
	Érd	3,337	30	16	*48·0*
	Batta	1,134	10	3	*26·4*
	Adony	4,421	3	2	*4·5*
	Rácz-Almás	3,603	12	7	*19·4*
	Vaál	3,011	3	2	*6·6*
	Ercsi	5,670	27	12	*21·2*
	Apostag	472	1	1	[*21·2*]
	Dunapentele	3,637	1	1	[*2·8*]
	K-Nyék	1,758	1	1	[*5·7*]
	Polgárdi	3,454	1	—	*0·0*
	Herczegfalva	7,380	1	1	[*1·4*]
Pest-Pilis-Solt-Kis-Kun. [October 4.]	Soroksár	12,147	24	16	*13·2*
	Sziget-Monostor	1,105	3	2	*18·1*
	Foktö	3,542	13	6	*16·9*
	Uszód	2,372	15	8	*33·7*
	Szt.-István	4,100	1	1	[*2·4*]
	Vácz	14,600	13	10	*6·8*
	Dunavecse	4,382	7	6	*13·7*
	Dunakeszi	5,562	5	3	*5·4*
	Fajsz	3,738	1	1	[*2·7*]
	Ujpest	25,000	12	9	*3·6*
	Kalocsa	10,387	2	2	*1·9*
	Czegléd	27,524	5	4	*1·5*
	Csömör	2,451	1	1	[*4·1*]
	Dunapataj	5,645	7	6	*10·6*
	Apostag	2,292	2	1	[*4·4*]
	Kis-Test	4,478	4	3	*6·7*
	Nagy-Tétény	2,426	15	5	*20·6*
	Vörösvár	2,460	1	1	[*4·2*]
	Dunaegyháza	2,176	3	3	*13·8*
	Tápió-Ságh	1,445	5	2	*13·8*
	Szada	1,034	1	1	[*9·7*]
	Sükösd	4,500	1	1	[*2·2*]
	Rákos-Palota	6,000	1	1	[*1·7*]
	Budafok	4,352	1	1	[*2·3*]
	Pilis-Csaba	1,900	3	2	*10·5*
	Dusnok	3,380	3	2	*5·9*
	Hajós	3,900	1	1	[*2·6*]
	Jász-Kara-Jenö	5,600	1	1	[*1·8*]
[October 8.]	SZEGED	85,569	38	28	*3·3*

TABLE E.—*continued.*

County. (Date of Invasion given in Brackets [ ].)	Town or Village. (Municipal Towns printed in Small Capitals.)	Population.	Total recorded Cholera		Cholera Death-rate per 10,000 Population 1892.
			Attacks.	Deaths.	
Csongrád [October 8.]	Csongrád	20,802	4	2	0·9
	Szegvár	6,810	3	2	2·9
	Szentes	30,791	2	1	[0·3]
	Mindszent	12,033	3	2	1·7
	Dorozsma	12,325	1	1	[0·5]
Esztergom [October 9.]	Táth	937	21	10	106·7
	Szt-Györgymező	2,698	3	—	0·0
	Dömös	1,260	4	2	15·9
	Sárisáp	1,330	34	9	67·7
	Esztergom	9,349	12	6	6·4
	Szt.-Tamás	2,544	9	4	15·7
	Dágh	711	1	1	[14·1]
	Pilismarót	1,857	1	—	0·0
	Lábatlan	1,377	1	1	[7·2]
	Bart	1,109	1	1	[9·0]
	Párkány	2,417	3	2	8·3
Komárom [October 9.]	Guta	7,088	18	7	9·9
	Zöldállás puszta	?	5	3	?
Turócz [October 9.]	Ruttka	2,933	1	1	[3·4]
Baranya [October 10.]	Mohács	14,468	38	19	13·1
	D-Szekcsö	5,385	1	1	[1·9]
	Nádasd	2,717	2	2	7·3
Bács-Bodrog [October 10.]	Titel	4,314	35	22	51·0
	Mohol	7,782	13	7	9·0
	Ada	9,693	17	12	12·4
	Uj-Verbász	5,959	4	4	6·7
	Zenta	26,000	38	24	9·2
	Ó-Becse	16,965	1	1	[0·6]
	Szónta	5,008	20	12	24·0
	Szántova	3,358	14	10	29·7
	Martonos	5,126	2	2	3·9
	Doroszló	2,911	1	1	[3·4]
	Uj-Futtak	3,351	2	2	6·0
	Szt-Tamás	11,729	1	1	[0·8]
	Gombos telep	?	1	1	?
	Csurogh	7,773	1	1	[1·3]
	Bezdán	8,366	1	1	[1·2]
	Pr-Szt-Iván	4,824	1	1	[2·1]
	Bogojeva	2,528	1	1	[4·0]
Krassó-Szörény [October 11.]	Orsova	3,564	1	1	[2·5]
	Báziás	?	2	2	?
Torontál (part of). [October 14.]	T.-Becse	7,276	11	5	6·9
	B.-Szt-György	3,260	9	3	9·2
	N.-Becskerek	21,934	64	33	15·0
	M.-Ittebe	2,243	20	13	58·0
	Szerb-Ittebe	4,802	28	19	39·5
	Szerb-Aradácz	1,896	179	114	602·0
	Kis-Torák	2,959	4	1	[3·4]
	Ó-Felek	3,684	4	2	5·4
	N.-Szt.-Márton	803	1	1	[12·4]
	Csebza	1,609	1	1	[6·2]
	Lilimajor	52	1	—	0·0
	Drexlermajor	?	1	1	?

TABLE E.—*continued.*

County. (Date of Invasion given in Brackets [ ].)	Town or Village. (Municipal Towns printed in Small Capitals.)	Population.	Total recorded Cholera		Cholera Death-rate per 10,000 Population 1892.
			Attacks.	Deaths.	
Torontál—*cont.*	Lázárföld	1,992	1	1	[5·0]
	Ormody puszta	?	3	2	?
	Szerb-Neuzina	2,242	1	1	[4·5]
	Ozora	5,935	1	1	[1·7]
	Szerb-Elemér	3,500	4	3	8·6
	Tót.-Aradácz	2,272	2	2	8·8
	Écska	2,769	2	2	7·2
	T.-Erzsébetlak	1,592	2	2	12·6
	T.-Kanizsa	3,429	1	1	[2·9]
	N.-Kikinda	22,778	1	1	[0·4]
	Mellencze	8,691	1	1	[1·1]
	Martinicza puszta	98	49	15	1530·0
	Lajosmajor	108	26	12	1112·0
	Tóba	1,695	17	5	29·5
	Uj-Szt-Iván	1,089	15	4	36·7
	N.-Torák	3,595	9	3	8·3
Bars [October 18.]	Jánosgyarmat	1,493	1	—	0·0
	Uj-Gyarmat	1,150	5	4	34·8
Temes [October 20.]	Szakálháza	3,860	1	1	[2·6]
	N.-Szt-Mihály	1,436	1	1	[7·0]
	Szt.-Mihály puszta	?	2	2	?
	Ságh	2,674	3	2	7·5
	Jaszenova	2,050	1	1	[4·9]
Zólyom [October 21.]	Dobronya	1,752	6	4	22·8
[October 21]	BAJA	20,000	7	6	3·0
[October 21]	UJVIDÉK	24,714	8	6	2·4
Pozsony [October 22.]	Schweinsbach	966	3	2	20·7
	Czajla	1,281	1	1	[7·8]
	Nagy-Bodak	739	3	2	27·0
Békés [October 22.]	Csaba	34,243	2	2	0·6
	Békés	25,087	1	1	[0·4]
[October 23]	POZONY	52,444	3	2	0·4
Jász-Nagy-Kun-Szolnok. [October 24.]	Szolnok	20,640	34	20	9·7
	Jászberény	24,380	1	1	[0·4]
	Kunhegyes	8,449	1	—	0·0
	Madaras	7,682	1	—	0·0
	V.-Ujszállás	12,424	1	—	0·0
	T.-Inoka	1,052	1	—	0·0
	T.-Várkony	2,312	2	—	0·0
	Szelevény	2,228	4	2	9·0
	Martfü puszta	?	1	1	?
	Mezötur	23,757	2	2	0·8

TABLE E.—*continued.*

County. (Date of Invasion given in Brackets [ ].)	Town or Village. (Municipal Towns printed in Small Capitals.)	Population.	Total recorded Cholera		Cholera Death-rate per 10,000 Population 1892.
			Attacks.	Deaths.	
Liptó - - [October 24.]	Liszkófalu -	1,630	14	5	*30·7*
	Okolicsnó -	830	1	—	*0·0*
	Szt.-András -	320	1	1	[*31·2*]
	Rózsahely -	3,394	3	3	*8·8*
	Jalócz - -	310	1	1	[*32·2*]
	Benedekfalu -	369	1	—	*0·0*
	Lykavka - -	1,872	7	4	*21·4*
	Madocsány -	1,117	1	—	*0·0*
	Liptó-Tepla -	703	11	5	*71·1*
	Verbócz - -	1,867	1	1	[*5·4*]
	Kelemenfalu	324	3	3	*92·5*
Hont - - [October 28.]	Szob - -	1,975	8	5	*25·3*
Arad - - [October ?]	Uj-Panát -	2,098	11	7	*33·3*
Györ - - [October ?]	Pinnyéd - -	353	3	1	[*28·3*]
	Gönyö - -	1,450	7	3	*22·1*
Sopron - - [October ?]	Kapuvár - -	6,000	31	15	*25·0*
	Gartha - -	1,527	3	1	[*6·5*]
	Osli - -	1,148	1	1	[*8·7*]
	Bánfalva - -	1,684	2	1	[*5·9*]
	Csorna - -	6,090	1	1	[*1·6*]
Trencsén - [October ?]	N.-Kotessó -	545	1	1	[*18·3*]
	Sebestyénfalu -	333	15	10	*300·5*
	Csácza - -	4,000	2	2	*5·0*
Veszprém - [October ?]	Várpalota -	5,161	1	1	[*1·9*]
	Papkeszi (Puszta-Sári).	881	5	5	*56·8*
Zemplén - [October ?]	Felsö-Körtvélyes -	471	1	1	[*21·2*]
[October ?] -	ARAD - -	42,902	2	1	[*0·2*]
[Do.] -	PANCSOVA -	17,948	1	1	[*0·6*]
[Do.] -	SELMECZ - -	15,280	1	1	[*0·7*]
[Do.] -	TEMSEVÁR -	41,000	8	3	*0·7*
[Do.] -	ZOMBOR - -	26,435	1	1	[*0·4*]

No. 13.

App. A. No. 13

Port and Riparian Sanitary Districts inspected during 1892.

ABSTRACTS of INSPECTORS' REPORTS on the SANITARY SURVEY of PORT and RIPARIAN SANITARY DISTRICTS inspected during 1892.

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App. A. No. 13.

Port and Riparian Sanitary Districts inspected during 1892.

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[Note.—In these abstracts the following abbreviations have been used: M.O.H. for Medical Officer of Health; I. of N. for Inspector of Nuisances; S.A. or D. for Sanitary Authority or District; P., Port; U., Urban; R., Rural.]

PORT SANITARY DISTRICTS INSPECTED DURING 1892; WITH CERTAIN SPECIFIED PARTICULARS OF SHIPPING TRADE AND SANITARY ADMINISTRATION.

EAST COAST.

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION.

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
1	BLYTH (RIVER) - [Jan. 20th, 1887.]	(Joint Board) "The River "Blyth Port Sanitary Au- "thority," composed as follows:— Members. South Blyth U.S.A. - 3 Cowpen U.S.A. - 7 Bedlingtonshire U.S.A. 2	South Blyth U.S.D. - 1/3 Cowpen U.S.D. - 7/13 Bedlingtonshire U.S.D. - 3/13	North Shields (part of).	1. Baltic ports, Hamburg, Antwerp, and Mediterranean. *Trade.*—Timber from the Baltic. Export of coal, ships returning in ballast. Trade much increased in recent years. 2. None.	881	1,013	M.O.H. to South Blyth U.S.D.
2	TYNE (RIVER) - [May 18th, 1882.]	(Joint Board) "The River "Tyne Port Sanitary Au- "thority," composed as follows:— Members. Newcastle U.S.A. - 6 Gateshead U.S.A. - 2 Tynemouth U.S.A. - 2 South Shields U.S.A. - 2 Jarrow U.S.A. - - 1 Felling and Hebburn U.S.A.s - - 1 Howdon, Walker, Wallsend, and Willington Quay U.S.A.s 1	Felling, Gateshead, Hebburn, Howdon, Jarrow, Newcastle-on-Tyne, South Shields, Tynemouth, Walker, Wallsend, and Willington Quay U.S.D.s. These Riparian Districts contribute.	Newcastle (all); North and South Shields (part of).	1. Baltic ports, Rotterdam, Hamburg, France, Spain, Mediterranean, America, &c. Very little transmigrant traffic. 2. Three miles above High Level Bridge only.	6,163	10,722	M.O.H. to Newcastle-on-Tyne U.S.D. Assistant P.M.O.H. also appointed.
3	SUNDERLAND - [April 27th, 1878, as amended by Borough of Sunderland Act, 1885.]	Sunderland Town Council -	Sunderland and Southwick U.S.D.s; Sunderland R.S.D. Port expenses borne by Sunderland U.S.D.	Sunderland (part of).	1. Baltic and Dutch ports, Spain, France, Mediterranean, and Black Sea. 2. None.	1,331	5,674	M.O.H. to Sunderland U.S.D.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
1	I. of N. to South Blyth U.S.D.	Vessels hailed and questions put at Fish Quay.	No mooring station fixed up to time of inspection.	P.S.A. have use of South Blyth U.S.A.s hospital for four beds. Hospital conveniently situated and ready for use. Nurse retained. Conveyance of patients by boat and stretcher. Water from South Blyth Waterworks. Drainage into sewer. Mortuary provided. No proper means of disinfection.	Vessels said to be inspected but apparently in a perfunctory manner.	Dr. Barry	Prior to inspection no special arrangements made. P.S.A., however, appeared anxious to carry out cholera regulations. Arrangements made for Customs authorities to board all vessels from infected ports outside the harbour, and "mooring station" fixed at the Dolphin Buoys on the north side of the river. P.S.A. also appointed additional Port Inspector of Nuisances, and arranged for burial of persons dying of cholera.
2	Two Port Inspectors of Nuisances.	Entrance to River Tyne.	Mooring station fixed at Jarrow Slake.	Pontoon hospital at Jarrow Slake, 30 beds. Steam launch with cot for removal of patients. Water supply from Sunderland Corporation. Drainage into Tyne estuary. "Disinfection" apparatus for sulphur fumigation, and mortuary at Pontoon hospital.	Yes	Dr. Barry	As a result of conference one ward at Pontoon hospital was at once fitted up for reception of cholera patients, and arrangements made for services of nurses at a moment's notice. Arrangements also made for burial of cholera patients in Jarrow cemetery. Arrangements generally satisfactory.
3	Special	Estuary of River Wear near entrance to docks.	No mooring station fixed prior to date of inspection.	No hospital provision made prior to date of inspection.	Yes	Dr. Barry	District re-inspected by Dr. Barry five days after first inspection. In the interval a mooring station had been fixed in the estuary of the Wear just below the Boarding station, and P.S.A. had commenced erection of a hut hospital on shore. Owing to opposition of residents a floating hospital has since been provided near mooring station.

* The dates given in this column are the dates of the Orders permanently constituting Port Sanitary Districts. The Districts printed in italics are only temporarily constituted.
† The Sanitary Districts mentioned in this column are in most instances limited to those referred to in the Orders constituting the Port Sanitary Districts. While, therefore, they doubtless include such as are of main importance from a cholera point of view, they do not necessarily include all the Riparian Districts embraced by each Port Sanitary District.

EAST COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
4	HARTLEPOOL [April 1st, 1881.]	(Joint Board) "The Hartlepool Port Sanitary Authority," composed as follows:— Members. Hartlepool U.S.A. - 3; West Hartlepool U.S.A. 9; Middleton-in-Stranton U.S.A. - - - 1; Throston U.S.A. - 2	Hartlepool U.S.D. (whole); West Hartlepool U.S.D. (whole); Middleton-in-Stranton U.S.D. (whole); Throston U.S.D. (whole). All contribute to port expenses.	Hartlepool (part of).	1. Hamburg, the Baltic, Spanish, and other ports. Two emigrant ships each week from Hamburg, bringing from 50 to 150 emigrants *en route* for America *vid* Liverpool. 2. —	1,255	2,382	P.M.O.H. special.
5	TEES (RIVER) [Jan. 2nd, 1886.]	(Joint Board) "The River Tees Port Sanitary Authority," composed as follows:— Members. Middlesbro' U.S.A. - 7; Stockton U.S.A. - 3; Eston U.S.A. - - 2; South Stockton U.S.A. 2; Normanby U.S.A. - 1; Stockton R.S.A. (part) 1	Middlesbrough U.S.D. (whole) - - - 11/12; Stockton U.S.D. (whole) - 5/6; Eston U.S.D. (whole) - 3/4; South Stockton U.S.D. (whole) - - - 5/6; Normanby U.S.D. (whole) 5/6; Kirkleatham U.S.D. (whole) - - - 3/4; Stockton R.S.D. (part) - 5/6; Guisborough R.S.D. (part) 0; Hartlepool R.S.D. (part) - 0; Middlesbrough R.S.D. (part) - - - 0	Middlesbro' (part of); Stockton (part of).	1. The Baltic, Norway, Sweden, Hamburg, Rotterdam, Antwerp, France, Spain, &c. Considerable coasting trade. 2. —	1,280	2,206	M.O.H. to Middlesbrough U.S.A.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
4	P.I. of N., special.	In the old harbour at entrance to the North basin.	No mooring station definitely fixed at time of inspection.	Wooden hospital near cemetery outside town. Hospital would accommodate 12 or 14 patients. Two huts with each two wards. Old fly provided for ambulance. Washington Lyon disinfecting apparatus at hospital.	Yes	Mr. T. W. Thompson.	P.M.O.H. instructed by P.S.A. to inspect all vessels from infected ports. A new ambulance has been ordered by P.S.A. Following upon conference with P.S.A. an additional P.I. of N. was appointed temporarily, and assistance provided for P.M.O.H. It was also decided to erect an additional wooden pavilion at the hospital expressly for cholera cases. There is great difficulty as to a mooring station at Hartlepool, owing to the unsafe character of the anchorage outside the harbour. The only available place for mooring said to be the "Central" Dock, and it was decided to use this.
5	P.I. of N., special.	—	Mooring station fixed near Eston bank of the Tees about 2¼ miles below Middlesbro'.	Old hospital ship lying in creek some little distance above Middlesbrough. Accommodation for six patients. No disinfecting apparatus. Cholera-infected articles to be burnt. Steam launch for conveyance of patients.	Yes	Mr. T. W. Thompson.	P.S.A. averse to using existing hospital for cholera, on the ground of its position above Middlesbrough. As it was found that this hospital ship was too old to stand the strain of moving, P.S.A. obtained leave from Tees Commissioners to use some isolated cottages at Seaton Snook (near the mouth of the Tees) as a temporary cholera hospital. Assistant P.I. of N. appointed temporarily.

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EAST COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
6	HULL and GOOLE [June 11th, 1887.]	(Joint Board) "The Hull "and Goole Port Sanitary "Authority," composed as follows:— Members. Kingston-upon-Hull U.S.A. - - - 3 Goole U.S.A. - - 2	Kingston-upon-Hull U.S.D. $\frac{4}{5}$ Goole U.S.D. - - - $\frac{1}{5}$	Goole (all); Hull (part of).	1. Denmark, Sweden, Germany, Russia (Baltic ports), France, Mediterranean, Black Sea, India. Weekly traffic between Hull and Hamburg, Antwerp, and Gottenburgh brings large numbers of transmigrants (300 per week from Hamburg alone). Many from Scandinavia *en route* to America *vid* Liverpool. Total transmigrants in 1891, 63,869. 2. Aire and Calder Canal, Trent Navigation, Ouse Navigation, Lincoln, &c.	4,770	3,642	M.O.H. to Kingston-on-Hull U.S.D. Asst. M.O.H. to Kingston-upon-Hull U.S.D. acts as Asst. P.M.O.H.
7	GRIMSBY - - [Sept. 24th, 1887. Amended by Order Sept. 21st, 1891.]	Grimsby Town Council -	Grimsby U.S.D. (whole) - $\frac{12}{12}$	Grimsby (part of).	1. The Baltic, Hamburg, Rotterdam, Antwerp, France, Black Sea, and America. Also an important fishing trade. 2. —	1,551	293	M.O.H. to Grimsby U.S.D. Deputy P.M.O.H. (special) has been temporarily appointed.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 23, 1892.				
6	One Chief Port Inspector and two Asst. Port Inspectors.	At a point between the Albert and Victoria Docks.	Satisfactory mooring station fixed at White Booth Roads.	P.S.A. have entered into an agreement with the Hull Town Council whereby they have acquired the use of the Garrison Hospital, a wooden building giving accommodation for 50 patients. This is fully equipped and ready for reception of cases. It is well situated and access is obtained by water. Arrangements made for securing sole use of a tug boat, at a moment's notice, for conveyance of patients. Tents also ready if required. Corporation water. Drainage into estuary. Ransome's disinfecting apparatus, and mortuary, at Garrison Hospital.	Yes	Dr. Barry -	P.S.A. have hired a steam launch for the use of their officers. They have also arranged with a medical man at Goole to inspect any case of sickness occurring on board ship before arriving at Goole from Hull. Arrangements generally satisfactory. Since the inspection the Humber Pilots have expressed the opinion that the mooring station fixed upon in White Booth Roads does not afford safe anchorage for heavy draughted ships, and the P.S.A. have applied for the Board's consent to their fixing a mooring station at a point between "No. 6 Sunk Spit Buoy and No. 7 Black." This would appear to be in the Grimsby Customs Port, and the matter is still under consideration of the Board. (December 1892.)
7	P.I. of N., special.	In the Port "Basin" close to entrance to the docks.	Mooring station fixed in the River Humber about 3 miles from Grimsby and ½ mile from Patrington, or north, shore.	P.S.A. possess no hospital for infectious diseases. U.S.A.'s hospital unsuitable for reception of cholera cases.	Yes	Dr. T. Thomson.	Subsequently to inspection a steamer was hired by P.S.A. for use as a hospital. A steam launch for general port sanitary service and conveyance of patients to hospital ship was also hired. P.S.A. resolved to purchase a steam disinfecting apparatus. Customs boarding station reported as unsatisfactory on the goounds of proximity to quays and docks, and the impossibility of sending a vessel from the port "basin" to the mooring station in certain states of the tide.

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App. A. No. 1. Port and Riparian Sanitary Districts uninspected during 1892.

EAST COAST—*continued.*

Port Sanitary Districts inspected during 1892; with certain specified Particulars of Shipping Trade and Sanitary Administration—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891.		Port Medical Officer of Health.
						From Foreign.	Coastwise.	
8	BOSTON - - [Nov. 21st, 1887.]	(Joint Board) "The Boston "Port Sanitary Authority," composed as under:— Members. Boston U.S.A. - - 5 Boston R.S.A. - - 2	Boston U.S.A. (whole); Boston R.S.A. (part of). Both contribute towards port expenses.	Boston (part of).	1. Hamburg (two vessels each week). Antwerp (one vessel each week). Some trade with the Baltic and Black Sea ports. No emigrant or systematic passenger traffic. 2. ——	199	397	M.O.H. for Boston U.S.D.
9	WISBECH - - [April 30th, 1879.]	The Town Council - -	Sutton Bridge U.S.D.; Walsoken U.S.D.; Holbeach R.S.D. (part); Wisbech R.S.D. (part). All contribute.	Wisbech (whole of).	1. Chiefly with the Baltic ports; also with North America and Gulf of Florida. 2. None.	103	178	M.O.H. for Sutton Bridge U.S.D.
10	KING'S LYNN - [Jan. 25th, 1889.]	The King's Lynn Town Council.	King's Lynn U.S.D.; Freebridge R.S.D.; King's Lynn R.S.D.; Wisbech R.S.D. The Riparian districts all contribute to port expenses.	Lynn (part of)	1. Hamburg (about three ships a fortnight), Antwerp (one ship each week), Baltic and other ports. Trade consists of timber, corn, general merchandise, and fresh fruit. No emigrant traffic. 2. By rivers Ouse and Cam with Ely, St. Ives, Huntingdon, Bedford, and Cambridge.	283	757	M.O.H. to King's Lynn U.S.D.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6. Cholera Regulations, Aug. 28, 1890.				
8	I. of N. for Boston U.S.D.	At "Hob Hole" about half way down the river (three and a half miles below Boston).	At "Clay Hole" in Boston Deeps (seven miles from Boston).	Same as in 1884, viz., an old farm house, fairly isolated and about a mile and a half from the town. Hospital accessible without passing through the town. It contains five separate rooms for patients, but each room could only accommodate one patient. Water supply, rain water. Drainage into cesspool. Room for extension. No disinfecting apparatus. An old omnibus as ambulance.	Not stated for 1892. In 1884 vessels were not inspected under P.H. Acts.	Mr. T. W. Thompson.	In 1884 the Customs boarding station was in "Clay Hole," and vessels were thus boarded by the Customs officers before entering the river. This for sanitary purposes was far more satisfactory than the present arrangements, by which vessels are boarded at "Hob Hole," half way up the river, as owing to local circumstances a vessel then found to be infected must be allowed to come on into the dock. To obviate this as far as possible, P.S.A. decided that during the danger of cholera importation, all ships coming from infected ports should be boarded by their M.O.H. in Boston Deeps, and to enable this to be accomplished they appointed a temporary Asst. P.M.O.H. They also appointed a special (temporary) P.I. of N. to reside at the Pilot station at Boston Deeps, and board every vessel coming inwards whether from an infected port or not.
9	P.I. of N., special.	At Wisbech "Eye" off the mouth of the river.	Mooring station fixed at Wisbech "Eye."	Satisfactory hospital near the river, about a mile below Sutton Bridge, and eight miles below Wisbech. Water would be sent from Wisbech. Mortuary at hospital.	—	Dr. Copeman	P.S.A. advised by Dr. Copeman to provide a steam disinfecting apparatus without delay.
10	I. of N. to King's Lynn U.S.D.	In the river at the entrance to the dock.	Between Whiting Sand and Bar Flat in the Roads about twelve miles from the dock.	Same as in 1884, but with addition of a ward block said to be capable of accommodating eight patients. P.S.A. possess no disinfecting apparatus, sulphur fumigation being relied on. An old omnibus is kept at town's yard for use as an ambulance.	—	Mr. T. W. Thompson.	Vessels discovered to be infected at the Customs boarding station could usually, it is said, either proceed on the same tide to the mooring station or be moored in the river until the tide served. At a conference the P.S.A. were advised to provide an efficient disinfecting apparatus and proper ambulance. Pilots have been instructed not to bring any vessels with sickness on board up the river to the dock until examined by P.M.O.H.

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EAST COAST—*continued.*

Port Sanitary Districts inspected during 1892; with certain specified Particulars of Shipping Trade and Sanitary Administration—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891.		Port Medical Officer of Health.
						From Foreign.	Coastwise.	
11	WELLS - - [Sept. 6th, 1887.]	The Wells Improvement Commissioners.	Wells U.S.A. (whole) - - $\frac{10}{10}$ Blofield R.S.D. (part of); Loddon and Clavering R.S.D. (part of); East and West Flegg R.S.D. (part of); Mutford and Lothingland R.S.D. (part of).	Lynn (part of)	1. In 1884, chiefly with Baltic ports, especially Riga and St. Petersburg. Occasionally with Holland; rarely with France. 2. None.	11	34	M.O.H. to Wells U.S.D.
12	YARMOUTH - - [Nov. 17th, 1887.]	The Yarmouth Town Council -	Yarmouth U.S.D. (whole) - $\frac{10}{10}$ Blofield R.S.D. (part); Loddon and Clavering R.S.D. (part); East and West Flegg R.S.D. (part).	Yarmouth (part of).	1. Norway and the Baltic. Trade chiefly timber. 2. With Norwich.	283	1,034	M.O.H. to Yarmouth U.S.D.
13	LOWESTOFT - [April 25th, 1879. Amended, April 10th, 1888.]	The Lowestoft Town Council -	Lowestoft U.S.D.; Mutford and Lothingland R.S.D. (part of). Both contribute to port expenses.	Lowestoft (part of).	1. Chiefly with the Baltic; a little with the Mediterranean, Black Sea, and Australia. A few French fishing boats. 2. Considerable with Norwich, Beccles, &c.	371	537	M.O.H. to Lowestoft U.S.D. and Mutford R.S.D.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
11	—	In ordinary times vessels are boarded at the quay side. But special arrangements have been made for the Customs officer to go out in the pilot tug to meet vessels while cholera is prevalent abroad.	Owing to the configuration of the coast no mooring station has been fixed upon. P.S.A. propose to send infected vessels on to Lynn Roads, and to notify their approach to the Lynn P.S.A. by telegraph.	A cottage on the Holkham Marsh has been hired for the purposes of isolation, and a trained nurse retained. For disinfection, P.S.A. rely upon the distribution of chemicals.	Fairly	Dr. Copeman.	——
12	I. of N. to Yarmouth U.S.D.	About a quarter of a mile within the mouth of the harbour.	About a mile out to sea just south of Gorleston Pill.	A disused collier fitted up as a floating hospital for eight patients. At present moored in the harbour, but would be towed out to sea near the mooring station if used for cholera patients. Goddard and Massey's steam disinfector available. Mortuary at urban isolation hospital.	—	Dr. Copeman.	——
13	I. of N. to Lowestoft U.S.D.	At the mouth of the outer harbour.	About a mile up the inner harbour, and to reach it all the shipping in the port has to be passed.	As in 1884. But the structure being of wood has suffered considerably by lapse of time. General arrangement of hospital very unsatisfactory. Mortuary very small, and built on to one of the wards. Goddard and Massey's steam disinfecting apparatus.	No	Dr. Copeman.	As a result of conference P.S.A. decided to erect an iron hospital on the site for the new sanatorium. Two fresh mooring stations have also been fixed outside the harbour, viz., 1. An anchorage "not nearer the harbour than in a line with Pakefield Street on the south"; 2. An anchorage not nearer the harbour than "in a line with Corton Pole on the north." The reason for appointing alternative mooring stations, is that one or other of them might be unsafe during the prevalence of certain winds.

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EAST COAST—*continued.*

Port Sanitary Districts inspected during 1892; with certain specified Particulars of Shipping Trade and Sanitary Administration—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
14	IPSWICH - - [May 21st, 1892.]	The Ipswich Town Council -	Ipswich U.S.D. (whole) - 1⅝ Samford R.S.D. (part of); Woodbridge R.S.D. (part of).	Ipswich (part of).	1. In 1884, chiefly with Baltic ports; a little with France, Spain, the Mediterranean, and the Black Sea. 2. —	180	3,382	M.O.H. to Ipswich U.S.D., Samford R.S.D., and Bosmere and Claydon R.S.D. The P.M.O.H. for Harwich has been appointed Deputy P.M.O.H. for Ipswich.
15	HARWICH - - [May 7th, 1881, as amended by Order May 31st, 1889.]	(Joint Board) "The Harwich "Port Sanitary Authority," composed as follows:— Members. Harwich U.S.A. - 6 Samford R.S.A. - 3 Tendring R.S.A. - 3 Felixstowe and Walton U.S.A. - - 1 Woodbridge R.S.A. - 1	The Harwich U.S.D. (whole); Felixstowe and Walton U.S.D. (part); Samford R.S.D. (part of); Tendring R.S.D. (part of); Woodbridge R.S.D. (part of). All contribute to port expenses.	Harwich (part of).	1. In 1884, with Denmark. With Hamburg, Rotterdam, and Antwerp (passenger traffic in connexion with G.E.R.). With the Baltic for timber. With America for grain. A little trade with the Black Sea. 2. —	—	—	M.O.H. to Harwich U.S.D. and Deputy P.M.O.H. for Ipswich.
16	COLCHESTER - [Aug. 6th, 1888.]	The Colchester Town Council -	The Colchester U.S.D.; Tendring R.S.D. (part of); Lexden and Winstree R.S.D. (part of). All contribute to port expenses.	Colchester (part of).	1. The Baltic (timber and corn). Cherbourg (butter). British ports. 2. None.	68	2,161	P.M.O.H. does not act as M.O.H. for any other district.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
14	In 1884 I. of N. to Ipswich U.S.D.	In 1884 vessels were boarded by the Ipswich Customs officer either at the Ipswich Docks or at Butterman's Bay some six or seven miles down the river. (*See* Remarks.)	In 1884 the appointed mooring station was at Levington Creek, about five miles below the town.	P.S.A. apparently have the use of the U.S.A.'s hospital as in 1884.	In 1884 occasional but not systematic inspection.	Dr. Parsons -	This port is entered through the port of Harwich, and vessels coming to Ipswich are in first instance boarded by the Harwich Customs officer. In the event of such officer meeting with an infected or "suspected" vessel, bound for Ipswich, he would inform the Deputy P.M.O.H. for Ipswich, who would board, and, if necessary, proceed up the river with the vessel and hand her over to the P.M.O.H. for Ipswich.
15	The P.S.A. have no I. of N.	In 1884 the Customs boarding station was in the middle of the harbour.	In 1884 between Shotley House and Bloody Point.	P.S.A. possess a small floating hospital containing two wards, one for three beds and the other for one bed.	No	Dr. Parsons -	It was decided at the conference, upon the advice of Dr. Parsons, that all vessels arriving from cholera-infected ports should be boarded by the P.M.O.H. or his deputy, and that assistance should be given to the P.M.O.H. for the purpose. It was also decided by the P.S.A. that the question of providing further isolation accommodation should be considered.
16	P.I. of N. does not, apparently, act for any other district.	Vessels boarded by Customs officers off Brightlingsea.	The mooring station is, apparently, in the River Colne off Brightlingsea.	At the time of inspection the floating hospital described in 1884 was still in use, but a new one was in process of construction. P.S.A. do not possess any disinfecting apparatus. There is no available mortuary.	Inspection of vessels imperfectly carried out.	Dr. Fletcher -	As a result of conference a temporary Asst. P.M.O.H. and a permanent Asst. P.I. of N. were appointed. The new floating hospital has since been completed and moored at her station.

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EAST COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
17	MALDON - - [Nov. 10th, 1888. Confirmed by Act, 1890.]	The Maldon Town Council -	The Maldon U.S.D. - - 1/6 The Maldon R.S.D. (part of) - - - 5/6	Colchester (part of).	1. The Baltic (timber and corn). Guernsey, Cherbourg, and Antwerp (granite). 2. Canal to Chelmsford, about 14 miles.	17	898	M.O.H. to Maldon U.S.D. As P.M.O.H, 10*l.* per annum.
18	LONDON - -	The Corporation of London -	Fifty-four Riparian Districts; the whole expenditure is borne by the Corporation of the City of London.	London (whole of).	1. "All ports or places in the known world having trade with Britain" (Customs). 2. By rivers, creeks, and canals; large inland traffic to various parts of the country.	7,302	7,454	Wm. Collingridge, M.D., D.P.H.; salary, 900*l.* per annum; devotes whole time to his duties. Is assisted by R. J. Reece, M.D., D.P.H., who gives his whole time to this work, and receives a salary of 10*l.* 10*s.* per week; also by Philip Whitcombe, M.R.C.S., who receives 210*l.* per annum, and is also engaged in private practice at Gravesend; also by deputy Medical Officers of Health at Sheerness and at Southend-on-Sea.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
17	I. of N. for port only. As P.I. of N. 24*l.* per annum.	Off Stansgate about six miles below Maldon.	At Stone Hole, near Stansgate.	No permanent isolation hospital. P.S.A. propose to rely upon a tent for four beds. The tent (bedding, &c.) is in readiness, and would be erected either at Upper Island or Stangatestone. Water would be sent from Maldon. P.S.A. have no mortuary or disinfecting apparatus.	Vessels said to be inspected by P.I. of N. aided by the coastguard men.	Dr. Fletcher	P.M.O.H. undertakes to visit all vessels arriving from foreign ports. P.S.A. advised by Dr. Fletcher to decide upon a site and have their tent hospital erected and kept in readiness.
18	Five Inspectors of Nuisances at salaries ranging from 3*l.* per week to 2*l.* per week, and devoting their whole time to their duties.	(1.) For the Medway (except as regards mail steamers for Queenborough), at Garrison Point. (2.) For mail steamers to Queenborough, at Queenborough; for Southend and Leigh, off Southend Pier; for Thames Haven and District,—from Holehaven Creek to Petroleum Wharf,—in Sea Reach. (3.) For London proper, in Gravesend Reach.	In the Gravesend Reach of the River Thames, opposite Port Sanitary Hospital.	Brick hospital, situated on the south bank of the Thames, about ¼ mile below Gravesend. Consists of administrative buildings and two ward blocks, each block containing two wards. Total accommodation (at 2,000 cubic feet air space per patient) amounts to 12 beds. Conveyance of patients on water by a steam launch belonging to Port Sanitary Authority, also by a partially decked row-boat, 30 feet long. Conveyance on land by means of stretchers belonging to P.S.A. Disinfection by a Scott's hot-air chamber, situated at the Port Sanitary Hospital.	Yes.	Dr. Theodore Thomson.	Subsequently to inspection two additional Medical Officers (Drs. Andrews and Williams) were appointed to assist M.O.H. in his duties, each at salary of 7*l.* 7*s.* per week; and a Washington-Lyons steam disinfecting chamber was procured and fitted up at the Port Sanitary Hospital.

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EAST COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891.		Port Medical Officer of Health.
						From Foreign.	Coastwise.	
19	ROCHESTER - - [May 16th, 1887,]	The Rochester Town Council -	Rochester U.S.D.; Chatham U.S.D.; Gillingham U.S.D.; Hoo R.S.D. (part); Malling R.S.D. (part); Medway R.S.D. (part); Milton R.S.D. (part); Strood R.S.D. (part). All contribute towards port expenses.	Rochester (whole of).	1. The Baltic, France, and the Channel Islands principally. Occasional vessels from Archangel, Canada, Burmah, and the Black Sea. 2. The Medway, a navigable river. Barges go up to Maidstone and Tunbridge.	252	8,185	M.O.H. to Rochester U.S.D. As P.M.O.H. 50*l.* per annum.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
19	Two P.I.'s of N., each receiving 10*l.* per annum. One is Deputy Harbour Master, and the other Collector of Shipping tolls.	At various points between Lower Upnor and Rochester Bridge. But all vessels coming from foreign to Rochester are in first instance boarded off Sheerness, the Customs officers there communicating with the Customs officers at Rochester by telegraph as to every vessel boarded.	Mooring station in Stangate Creek, agreed upon between P.S.A. and Queen's Harbour Master. It is in the Rochester P.S.D.	For the purpose of isolation P.S.A. have hired (for two months or longer, if required) a vessel said to be capable of accommodating 10 patients. It was being fitted up at time of inspection. For conveyance of patients and officers P.S.A. have the use of Medway Conservancy steam launch. P.S.A. have no disinfecting apparatus, but there is a hot-air chamber at the Rochester and Chatham joint isolation hospital. Mortuaries respectively at Rochester Town Quay, Sheerness pier, and at Rochester and Chatham Hospital.	Yes.	Dr. T. Thomson.	P.S.A. advised by Dr. Thomson to procure an efficient disinfecting apparatus. (The Rochester P.S.A. have made an arrangement by which they pay the M.O.H. of Queenborough U.S.D. to board vessels bound for Rochester at Sheerness, and to carry out, with regard to such vessels, the provisions contained in Articles 7, 8, and 9 of the Cholera Regulations of August 28th, 1890. Sheerness, however, is in the Port of London, and thus the Rochester P.S.A. are apparently exercising, and paying for, functions properly belonging to the P.S.A. of London. Further, it would seem that vessels bound for Queenborough (Port of London) are sent for detention, pending the arrival of the London P.M.O.H., into the district of the Rochester P.S.A.)

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SOUTH COAST.

Port Sanitary Districts inspected during 1892; with certain specified Particulars of Shipping Trade and Sanitary Administration.

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891.		Port Medical Officer of Health.
						From Foreign.	Coastwise.	
1	*Faversham* - -	The Faversham Town Council	Faversham U.S.D. (whole); Faversham R.S.D. (part of); Sheppey R.S.D. (part of). All contribute to port expenses.	Faversham (part of).	1. Chiefly the Baltic ports. (1885 Report. Trade limited to small craft by shallowness of water of the port.) 2. None.	22	2,068	M.O.H. to Faversham U.S.D.
2	SANDWICH - - [June 13th, 1888.]	Sandwich Town Council -	Sandwich U.S.D. (whole) - $\frac{19}{20}$ Eastry R.S.D. (part of); Isle of Thanet (part of).	Ramsgate (part of).	1. With French and Baltic ports. 2. Navigable river. Occasional barges go up to Grove Ferry.	5	104	M.O.H. for Sandwich U.S.D.
3	DEAL - - - [Nov. 28th, 1887.]	(Joint Board) "The Dover (Deal Division) Port Sanitary Authority," composed as follows:— Members. Deal U.S.A. - - 3 Walmer U.S.A. - 3	Deal U.S.D. (whole) - $\frac{1}{16}$ Walmer U.S.D. (whole) - $\frac{5}{16}$	Dover (part of)	1. Calais and Boulogne (passenger traffic). This is due to Margate and Ramsgate day-trip boats touching at Deal on their way to and from Calais and Boulogne. No other foreign traffic. 2. None.	19	162 (Including the trippers mentioned in Col. 6, which are reckoned as coasters).	M.O.H. to Deal U.S.D.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
1	P.I. of N. does not act for any other district.	Off the mouth of Faversham Creek.	Mooring station fixed in the East Swale, half way between Harty Ferry and Faversham Creek.	P.S.A. possess no means of isolating cholera or other infectious cases. U.S.A. are about to provide an infectious diseases hospital. P.S.A. have no disinfecting apparatus, ambulance, or mortuary.	Yes	Dr. T. Thomson.	Urged by Dr. Thomson to make immediate provision for the isolation of cholera patients, for their conveyance to hospital, and for the disinfection of infected articles.
2	I. of N. for Sandwich U.S.D., and also Harbour Master.	At some distance from the town—apparently in the river.	Mooring station fixed off Shellness, in the River Stour.	Neither the P.S.A. nor U.S.A. possess any isolation hospital, ambulance, disinfecting apparatus, or mortuary.	Yes	Dr. T. Thomson.	Strongly urged by Dr. Thomson to provide hospital accommodation, means of conveyance of patients to hospital, and a steam disinfecting apparatus.
3	I. of N. to Deal U.S.D.	Vessels not boarded by Customs officials except for special reason. At the time of inspection a (temporary?) arrangement had been made for all boats coming ashore from vessels in the Downs to be met and interrogated by Coastguardsmen.	Doubtful. (*See* Remarks.)	P.S.A. possess no hospital, and the isolation hospital of the U.S.A. is unfit for habitation. No disinfecting apparatus, U.S.A. relying on sulphur fumigation. There is a public mortuary capable of taking three or four bodies.	Not systematically.	Dr. T. Thomson.	P.S.A. urged to make immediate provision for the isolation of persons suffering from cholera or other infectious disease. Also advised to provide means of conveyance of patients from vessels to hospital, and of P.M.O.H. and P.I. of N. during their inspections of vessels. Further advised to procure a steam disinfecting apparatus. A mooring station in the Little Downs, nearly opposite Sandown Castle, was agreed upon between P.S.A. and Customs officials. It was subsequently ascertained that the proposed mooring station was not within the Dover Customs Port, and the Board is still in correspondence with the P.S.A. on the subject (December 1892).

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SOUTH COAST—*continued.*

Port Sanitary Districts inspected during 1892; with certain specified Particulars of Shipping Trade and Sanitary Administration—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
4	NEWHAVEN - - [Dec. 3rd, 1858.]	The Newhaven Local Board -	Newhaven U.S.D. (whole) 10/10	Newhaven (part of).	1. Dieppe, St. Nazaire, Honfleur, and the Baltic. Foreign traffic considerable (passengers and cargo). Coasting traffic chiefly with Cardiff, Hartlepool, and the Tyne. 2. Navigable river to Lewes and above. Traffic—barges carrying coal, grain, and timber.	1,292	1,015	P.M.O.H. at salary of 10*l.* 10*s.* per annum. Does not act for U.S.D.
5	NEW SHOREHAM - [Oct. 24th, 1892.]	(Joint Board) "The New "Shoreham Port Sanitary "Authority," composed as follows:— Members. Brighton U.S.A. - 3 Hove U.S.A. - - 2 New Shoreham U.S.A. 2 Steyning R.S.A. - 6	Brighton U.S.A. - - 3/5 Hove U.S.A. - - 1/5 New Shoreham U.S.A. - } 1/5 Steyning R.S.A. - - }	New Shoreham (part of).	1. Baltic and Northern French ports. 2. By River Adur. Barges containing sand and coal pass up to small villages.	307	328	M.O.H. to New Shoreham U.S.D. As P.M.O.H., 15*l.* per annum.
6	*Littlehampton* - -	(Joint Board) "The Littlehampton Port Sanitary "Authority," composed as follows:— Members. Littlehampton U.S.A. - 5 East Preston R.S.A. - 2	Littlehampton (whole) - U.S.A. } 5/7 East Preston (part) - R.S.A. } 2/7	Littlehampton (part of).	1. Baltic and Northern French ports. 2. ——	40	334	M.O.H. to Littlehampton U.S.D. As P.M.O.H., 12*l.* 12*s.* per annum.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
4	I. of N. to Newhaven and Seaford U.S.D.'s. As P.I. of N., 8*l.* per annum.	Just within the Harbour entrance.	Mooring station in Seaford Bay agreed upon by S.A. and Customs Officer at Inspection. In certain weather vessels would have to run elsewhere for shelter. [An alternative mooring station for rough weather seems to have been since fixed upon at entrance to river.]	The U.S.A. possess an infectious diseases hospital, but it is difficult of access and unsuitable for cholera cases. There is a hand stretcher and a horse ambulance, but no water ambulance, and no disinfecting apparatus. There is a mortuary at the cemetery.	Yes	Dr. T. Thomson.	P.S.A. urged by Dr. Thomson to at once make a suitable provision for the isolation of cholera patients; to provide means for the conveyance, by water, of their officers in the discharge of their duties, and for the removal to land of cholera patients met with on ship-board; also to provide a steam disinfecting apparatus. No correspondence between the Board and P.S.A. since. Hospital question reserved for coming Survey.
5	Harbour Master.	At entrance to harbour.	"Same as in 1885." Apparently the south side of the Western Channel.	P.S.A. possess a cholera "hospital," but it is very unsatisfactory, consisting of two old railway carriages, and is badly placed as regards accessibility. No ambulance, disinfecting apparatus, or mortuary. The U.S.A. possess no isolation hospital.	Yes	Dr. T. Thomson.	Need for more suitable hospital accommodation, ambulance, and disinfecting apparatus, pointed out to P.M.O.H. by Dr. Thomson. Mooring station doubtful. In 1885 it was not very satisfactory. On August 31st (the day after Dr. Thomson's inspection) the Clerk to the P.S.A. wrote to the Board to the effect that arrangements for fitting up the cholera hospital at once, if required, had been made.
6	Surveyor and I. of N. to Littlehampton U.S.A. As P.I. of N., 10*l.* 10*s.* per annum.	Just inside harbour entrance.	In the Arun at Runcorn Piles.	Neither P.S.A. nor U.S.A. possess any isolation hospital. P.S.A. have no disinfecting apparatus, no mortuary, and no ambulance.	Yes	Dr. T. Thomson.	P.S.A. advised to make suitable hospital provision, to procure an ambulance, and disinfecting apparatus, and to provide a mortuary. At the time of inspection P.S.A. were negotiating for the acquisition of a dwelling-house for use as a hospital. Dr. Thomson pointed out the unfitness of this building for the purpose in question, but did not discourage its temporary use, if required, pending the provision of more suitable accommodation.

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SOUTH COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891.		Port Medical Officer of Health.
						From Foreign.	Coastwise.	
7	*Portsmouth*	The Portsmouth Town Council	Portsmouth U.S.D.; Gosport and Alverstoke U.S.D.; Fareham U.S.D.; Fareham R.S.D. (part of).	Portsmouth (part of).	1. The Baltic, Norway, Sweden, Denmark, Holland, Germany, and France.	312	13,945	M.O.H. to U.S.D.
8	*Southampton*	The Southampton Town Council.	Southampton U.S.D. - $\frac{12}{13}$ Shirley and Freemantle U.S.D.; New Forest R.S.D.; South Stoneham R.S.D.	Southampton (part of).	1. Brazil, West Indies, Havre, Honfleur, Cherbourg, St. Malo, Channel Islands, &c. 2. By navigable rivers.	2,218	8,551	P.M.O.H. does not hold similar position for Urban District.
9	COWES [Aug. 5th, 1886]	(Joint Board) "The Cowes "Port Sanitary Authority," composed as follows:— Members. West Cowes U.S.A. - 5 East Cowes U.S.A. - 3 Newport U.S.A. - 2 Isle of Wight R.S.A. - 2	West Cowes U.S.D. - $\frac{1}{13}$ East Cowes U.S.D. - $\frac{1}{13}$ Newport U.S.D. - $\frac{1}{13}$ Isle of Wight R.S.D. (part) $\frac{1}{13}$	Cowes (part of).	1. Havre, Rouen, German, and Scandinavian ports. Considerable coasting traffic. 2. Navigable river (Medina).	19	5,239	M.O.H. to East and West Cowes U.S.D.'s.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
7	The Harbour Master.	Between Blockhouse Point and the north corner of the Dockyard (within the harbour).	Not fixed at time of inspection. A spot near Spithead seems since to have been selected.	P.S.A. possess no hospital and no ambulance arrangements for transport, either by land or water. Neither have they any disinfecting apparatus. Public mortuary in the town.	Yes	Dr. T. Thomson.	P.S.A. urged to provide hospital accommodation and means of transport for patients. Also to procure a suitable disinfecting apparatus, and to hire a launch for the use of their officers. They subsequently hired a ship for use as a hospital (temporarily) and decided to hire a launch for conveyance of their officers.
8	P.I. of N. does not hold similar position for Urban District.	No fixed boarding station. Some ships from foreign are boarded off Netley, others at the mouth of the Hamble, and others in the docks.	No mooring station fixed at time of inspection.	P.S.A. have no hospital for infectious diseases. U.S.A. have a hospital, but it is not suitable for the reception of cholera cases. P.S.A. have no ambulance or disinfecting apparatus.	Yes	Dr. T. Thomson.	Subsequently to the inspection, P.S.A. appointed an Asst. P.M.O.H. and an Asst. P.I. of N. (temporary †). They also fitted up the steamship "Morelay" as a floating hospital and arranged for the use of a steam launch for their officers, and the conveyance of patients to the floating hospital. With the approval of the Chief Officer of Customs they fixed a mooring station about half way between the Hamble River and Southampton. In addition to the floating hospital above mentioned a temporary corrugated iron hospital on the "Town Common," 2½ miles from the town, has been provided by the U.S.A.
9	Harbour Master; as P.I. of N., 20*l.* per annum.	In Cowes Roads.	On the south edge of the "Brambles," close to West Bramble buoy, about 2 miles from Isle of Wight and 4 miles from opposite shore.	P.S.A. have no hospital for infectious diseases, ambulance, or disinfecting apparatus. U.S.A. of East and West Cowes similarly unprovided for. Mortuary at cemetery.	Yes	Dr. T. Thomson.	P.S.A. strongly urged by Dr. Thomson to make suitable and immediate provision for the isolation of cholera patients, for the conveyance of such patients to hospital, and for the disinfection of cholera-infected articles. P.S.A. have since obtained, and fitted up, the yacht "Leada" for use as a port hospital.

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SOUTH COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
10	POOLE [Sept. 21st, 1887.]	The Poole Town Council	Poole U.S.D. $\frac{19}{20}$; Wareham U.S.D.; Poole R.S.D.; Wareham and Purbeck R.S.D.	Poole (part of)	1. Timber from the Baltic; stone from Guernsey and Cherbourg; wheat from France, Germany, Russia, Sweden, and Riga; occasionally moss litter from Antwerp. A few vessels from Mediterranean and American ports. Large coasting with Northern and Welsh ports and with London. 2. None.	117	835	M.O.H. to U.S.D. As P.M.O.H., 25*l.* per annum.
11	WEYMOUTH [June 5th, 1877.]	(Joint Board) "The Weymouth Port Sanitary Authority," composed as follows:— Members. Weymouth U.S.A. - 5; Portland U.S.A. - 3; Weymouth R.S.A - 2	Weymouth U.S.D. (whole); Portland U.S.D. (whole); Weymouth R.S.D. (part of). The Riparian Districts all contribute to expenses.	Weymouth (part of).	1. *Weymouth.*—Grain and wood from Baltic, Black Sea, and American ports; occasionally slates from Hamburg; fruit and vegetables from St. Malo and Channel Islands; coal from Welsh ports and Tyne. *Portland Roads.*—Very little foreign trade; occasional boats from West Coast of Africa and East Indies. Russian convict ships sometimes call for coal; considerable coasting trade. 2. None.	466	593	P.M.O.H. does not act as M.O.H to U.S.D. As P.M.O.H., 50*l.* per annum.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
10	Boro' Surveyor and I. of N. to U.S.D. As P.I. of N., 25*l.* per annum. There is also an Asst. P.I. of N. (temporary?)	Near entrance to the harbour.	Mooring station fixed in Wareham Channel above the "Red Buoy" considered satisfactory.	Permanent hospital for seven patients, as in 1884. In addition to this, a temporary hospital for eight patients has been erected on adjacent land, and there is still room for extension. Hospital site almost an island. Town water and drainage to foreshore. Van and boat for conveyance of patients. No disinfecting apparatus or mortuary.	Yes	Dr. Downes	P.M.O.H. will inspect all vessels from infected ports.
11	P.I. of N. does not act as I. of N to U.S.D. As P.I. of N., 25*l.* per annum.	During the daytime Weymouth vessels are usually boarded at mouth of harbour, and other vessels in Portland Roads. At night only vessels flying the quarantine flag are boarded, the staff of officers being said to be insufficient for a full night service.	Mooring station at back of Portland Breakwater. Approved by Queen's Harbour Master. In very bad weather vessels might have to run for shelter elsewhere.	P.S.A. possess an isolation hospital containing 24 beds; available also for U.S.D. and R.S.D. usually. Ample room for extension. Weymouth water laid on. Drainage into tideway. Earth closets. Hot air disinfecting apparatus, ambulance, and mortuary also provided.	Yes	Dr. Downes	Arrangements of P.S.A. generally satisfactory. P.M.O.H. visits all vessels from infected ports and examines the crew and passengers, unless they have been more than 10 days out. Use of hospital by U. and R.S.A.'s temporarily suspended, and hospital in readiness for cholera.

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SOUTH COAST—*continued.*

Port Sanitary Districts inspected during 1892; with certain specified Particulars of Shipping Trade and Sanitary Administration—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
12	EXETER - - [June 9th, 1888.]	(Joint Board) "The Exeter "Port Sanitary Authority," composed as follows:— Members. Exeter U.S.A. - - 5 Exmouth U.S.A. - 2 St. Thomas the Apostle U.S.A. - - - 1 St. Thomas R.S.A. - 3	Exeter U.S.D. (whole) - 1/1 Exmouth U.S.D. (whole) - 1/1 St. Thomas the Apostle U.S.D. - - - 1/1 St. Thomas R.S.A. (part) - 1/1 Newton Abbot R.S.D. (part) - - - 0	Exeter (part of).	1. In 1884, chiefly with Baltic, American, and French Ports. 2. —	91	833	M.O.H. to Exmouth U.S.D.
13	TEIGNMOUTH - [Aug. 10th, 1887.]	Teignmouth Local Board as U.S.A.	Teignmouth U.S.D. (whole); Newton Abbot R.S.D. (part).	Teignmouth (part of).	1. Chiefly wood pulp from Scandinavia. Coasting trade chiefly imports of coal from Newcastle, Glasgow, and Hull. 2. The River Teign to Newton Abbot.	23	359	M.O.H. to Teignmouth U.S.D.
14	DARTMOUTH AND TOTNES. [Mar. 16th, 1888. Confirmed by Local Government Board's Provisional Order Confirmation (Port) Act, 1888.]	(Joint Board) "The Dartmouth "and Totnes Port Sanitary "Authority," composed as follows:— Members. Clifton Dartmouth Hardness U.S.A. - 5 Totnes U.S.A. - - 1 Totnes R.S.A. - - 4	Clifton Dartmouth Hardness U.S.A. (whole) - 1/5 Totnes U.S.A. (whole) - 1/5 Totnes R.S.D. (part) - 4/5	Dartmouth (part of).	1. Coasting trade and coaling station for bunkering S.S. on route from port to port, principally from Baltic, North Europe, and Mediterranean. West Indian Mails shipped here. (Sir Donald Currie's boats no longer call.) 2. River Dart; discharge chiefly at Totnes.	862	398	M.O.H. to Dartmouth U.S.A. As P.M.O.H., 15l. per annum.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
12	The Exmouth Harbour Master.	In the Bight	At extreme head of Bight.	No provision for isolating cholera patients. There is an infectious disease hospital at Exeter, but it is 10 miles from Exmouth. P.S.A. possesses no distinfecting apparatus. No mortuary.	Apparently	Dr. Bulstrode	An assistant P.M.O.H., residing at Exmouth, appointed for one month (Sept. 1892?) with instructions to board and examine all vessels. P.S.A. advised by Dr. Bulstrode to provide means for isolating cases of cholera,‡ and for the disinfection of infected articles. Also to adopt the Infectious Disease (Notification) Act.
13	I. of N. to Teignmouth U.S.D.	At the "Point" (Shaldon Pool).	At the two buoys nearest Shaldon Bridge.	P.S.A. possess a hospital which, it is said, would accommodate five patients. It is, however, of a very unsatisfactory character. No disinfecting apparatus. P.S.A. have no mortuary. Mortuary of U.S.A. unsatisfactory.	Yes	Dr. Bulstrode	P.S.A. advised by Dr. Bulstrode to provide suitable isolation accommodation jointly with U.S.A., and an efficient disinfecting apparatus.
14	P.I. of N. appointed at salary of *40l.* per annum, but not to enter upon his duties till called upon. Not yet been called upon.	The "Bright" at entrance to harbour. But pilots have orders at present to bring up at the "Range," and as far as possible vessels from infected ports will be boarded there. P.M.O.H. objects to having to go to the "Range."	Mooring station fixed at the "Range" outside the harbour. But this being untenable in bad weather, the "Bright" will in such case be substituted.	No hospital yet provided. No ambulance. Mortuary belonging to U.S.A.	No	Dr. Downes	Chief Officer of Customs advised by Dr. Downes that *all* vessels touching at Dartmouth from infected ports should be reported to P.M.O.H., and that no vessel should be allowed further up the harbour than the "Bright," before being boarded. P.M.O.H. advised to inspect all vessels from infected ports and examine all persons on board such vessels. Also to urge his P.S.A. to provide isolation accommodation, means for disinfection, &c., immediately. Similar advice given to clerk as to isolation. Clerk also informed that the P.I. of N. should at once commence his duties. (A letter to the Board, dated Aug. 31st, 1892, from the clerk to the P.S.A., states that arrangements had that day been made for hire of a hulk for use as a temporary hospital. It states also that the hulk would accommodate from 15 to 20 patients, and that it would be ready for occupation in 24 hours. Arrangements had been made, it is further said, for P.I. of N. to enter upon his duties.)

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‡ Dr. Bulstrode suggested a joint hospital for the P.S.D. and Exmouth U.S.D.

SOUTH COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
15	KINGSBRIDGE AND SALCOMBE. [Sept. 28th, 1887.]	(Joint Board) "The Kingsbridge and Salcombe Port Sanitary Authority," composed as follows:— Members. Kingsbridge R.S.A. - 4 Salcombe U.S.A. - - 3	Kingsbridge B.S.D. (part) ½ Salcombe U.S.D. (whole) - ½	Dartmouth (part of).	1. Very little foreign trade. Coasting trade chiefly with Plymouth, Cardiff, and Hull (coals, stones, and general cargoes). Bi-weekly pleasure steamers between Kingsbridge and Plymouth. 2. Nothing beyond Kingsbridge.	19	634	M.O.H. to Salcombe U.S.D.
16	PLYMOUTH - - [May 16th, 1882.]	(Joint Board) "The Plymouth Port Sanitary Authority," composed as follows:— Members. Devonport U.S.A. - 2 Plymouth U.S.A - - 4 East Stonehouse U.S.A. 1 Plympton St. Mary R.S.A. - - - 1 St. Germans R.S.A. - 1	Devonport U.S.D. (whole); Plymouth U.S.D. (whole); East Stonehouse U.S.D. (whole); Plympton St. Mary R.S.D. (part); St. Germans R.S.D. (part). All contribute to port expenses.	Plymouth (part of).	1. With the Channel Islands, France, Corunna, and the Mediterranean ports. Mail boats from Marseilles, West Indies, the Cape, and Australia call at Plymouth. 2. ——	633	2,979	M.O.H. to Plymouth U.S.A. As P.M.O.H., 100*l.* per annum.
17	FOWEY - - [Nov. 20th, 1886.]	(Joint Board) "The Fowey Port Sanitary Authority," composed as follows:— Members. St. Austell R.S.A. - 5 Liskeard R.S.A. - - 2	St. Austell R.S.D. (part) - ⅔ Liskeard R.S.D. (part) - ⅓	Fowey (part of).	1. Trade mainly exports of china clay, and mining produce to America, Continental (?), Baltic, and Mediterranean ports. Imports of timber from Norway. 2. River navigable up to Lostwithiel.	179	1,753	P.M.O.H. does not act as M.O.H. for any other district.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
15	I. of N. to Salcombe U.S.D.	Off Salcombe	In the "Bug" off Westercomb.	No isolation accommodation, disinfecting apparatus, or mortuary.	Yes	Dr. Bulstrode	P.S.A. advised to provide floating or other isolation accommodation without delay; to adopt the Infectious Disease (Notification) Act; to procure an "Address Book"; and to make inquiries as to a nurse. No evidence at present that this advice has been carried out.
16	P.I. of N. at salary of 100*l.* per annum. Does not act for urban district.	In the Sound	Between the "Pique" and Bovisand. Approved by Queen's Harbour Master.	P.S.A. possess a floating hospital, viz., the "Pique," a wooden frigate lent them by the Admiralty. She is apparently well adapted to the purpose, but at the time of inspection she was occupied by urban cases of small-pox. It was proposed to transfer these to tents at the urban infectious hospital and reserve the "Pique," after disinfection, for cholera cases.	Yes	Dr. Downes	P.M.O.H. inspects all vessels coming from infected ports, and examines all persons on board such vessels.
17	P.I. of N. does not act as I. of N. for any other district.	At Fowey, outside an imaginary line drawn from the old castles on either side of the entrance to the harbour.	Up the River Fowey beyond Wiseman's stone.	Small iron hospital for four, or perhaps six, patients on opposite side of river to Fowey. Arrangements for nursing completed. Conveyance of patients by open boat. Water supply good. Drainage into cesspool. Disinfection by perchloride of mercury. No apparatus. No mortuary.	Yes	Dr. Bulstrode	At Charlestown, a port in the Fowey P.S.D., vessels from foreign are boarded by the Customs officer in the outer basin. Dr. Bulstrode considers that it would be safer if they were boarded before entering the basin, but the Customs officer has no boat for this purpose. P.M.O.H. advised by Dr. Bulstrode as to provision of a covered boat, and also a litter for carrying patients from vessels to the hospital at Fowey. As a result of a communication addressed by the Board to the Commissioners of Customs upon the subject of the boarding of vessels at Charlestown referred to by Dr. Bulstrode, the Commissioners of Customs have replied (Oct. 15th, 1892) that vessels coming to Charlestown from foreign "shall, if necessary, "be boarded before entering the dock." Since the inspection, P.S.A. have purchased and fitted up a boat for the conveyance of patients to hospital.

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SOUTH COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
18	**FALMOUTH AND TRURO.** [Aug. 23rd, 1893.]	(Joint Board) "The Falmouth and Truro Port Sanitary Authority," composed as follows:— Members. Falmouth U.S.A. (Borough) - 2; Penryn U.S.A. - 1; Truro U.S.A. - 4; Falmouth U.S.A. (Local Board) - 4; Falmouth R.S.A. - 1; Truro R.S.A. - 3	Falmouth U.S.D. (Borough) (whole) - 5/12; Penryn U.S.D. (whole) - 1/12; Truro U.S.D. (whole) - 1/1; Falmouth U.S.D. (Local Govt. Dist.) (whole) - 5/12; Falmouth R.S.D. (part) - 1/1; Truro R.S.D. (part) - 1/1	Truro (whole); Falmouth (part of).	1. France and Brittany, Mediterranean, Baltic and Black Sea. Regular trade with Spain now stopped. Falmouth may be regarded as a port for callers from all parts of the world. For one or other purpose some 2,500 vessels called in 1891. 2. Navigable river to Truro.	1,420	5,450	M.O.H. to Falmouth U.S.D.
19	*Penzance* - -	The Penzance Town Council -	Penzance U.S.D. (whole); Ludgvan U.S.D. (whole); Madron U.S.D. (whole); Penzance R.S.D. (part). All contribute towards port expenses.	Penzance (part of).	1. Grain from France, Morocco, Plate River, and Philadelphia. Salt from Hamburg. Timber from the Baltic and Russia. Potatoes from France. Manure from Brussels. Coals from South Wales, the Mersey, and Newcastle. Also a considerable fishing trade. 2. None.	30	821	M.O.H. to Penzance U.S.D.
20	*Hayle* - - -	The Hayle Local Board as U.S.A.	Hayle U.S.D. (whole) - 12/12; St. Ives U.S.D.; Phillack U.S.D.; Penzance R.S.D. (part); Redruth R.S.D. (part).	Penzance (part of).	1. Norway, the Baltic, and the Channel Islands. Coasting trade with South Wales and North-east Coast. 2. None.	7	604	M.O.H. to Hayle and Phillack U.S.D.'s.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28, 1890.				
18	P.I. of N. is apparently only expected to carry out specific orders.	Just inside the Zose Point.	In Cross Road just above the old "Quarantine Pool."	Small wooden hospital containing two wards with each only 1,620 cubic feet of air-space. Situation of hospital good, but accommodation insufficient. Mortuary near hospital. No disinfecting apparatus.	No	Dr. Bulstrode	P.S.A. advised by Dr. Bulstrode to appoint a P.I. of N. who would devote the whole of his time to port work. Also to provide a disinfecting apparatus. P.S.A. apparently very unwilling to incur any expense.
19	I. of N. to Penzance U.S.D.	In the roadstead within half a mile of the pier head at Penzance harbour.	In Gwavas Lake, but in very bad weather vessels would have to take refuge under St. Michael's Mount.	U.S.A. possess an isolation hospital, but owing to its proximity to dwellings, it is not proposed to use it for cholera. For this latter purpose P.S.A. have purchased a tent and obtained a well-isolated site for its erection. Water supply said to be good. Excreta would be burnt or buried after disinfection. An old fly for ambulance. The U.S.A. possess a small hot-air disinfecting apparatus. There is a mortuary at the cemetery.	Inspection said to be carried out.	Dr. Bulstrode	Up to the time of Dr. Bulstrode's visit little or no attention had been paid to any parts of the Port Sanitary District but Penzance proper. Dr. Bulstrode, however, pointed out to the P.M.O.H. and the Chief Officer of Customs the possibility of cholera being introduced to Newlyn or Mousehole by fishing boats (some of which, it is said, get as far as the French coast). The officers in question undertook to exercise precautions in the matter.
20	I. of N. to Hayle U.S.D.	Inside Hayle Harbour.	Off the "Dynamite Station" near entrance to harbour.	No isolation accommodation, disinfecting apparatus, or mortuary.	No	Dr. Bulstrode	I. of N. instructed as to inspection of vessels under Public Health Act. P.S.A. urged by Dr. Bulstrode to provide isolation accommodation.

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WEST COAST.

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION.

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
1	PADSTOW [Jan. 10th, 1887.]	(Joint Board) "The Padstow "Port Sanitary Authority," composed as follows:— Members. Padstow U.S.A. - 1; Bodmin R.S.A. - 3; St. Columb Major R.S.D. - 3	Padstow U.S.D. - - ½; Bodmin R.S.D. (part) - ⅛; St. Columb Major R.S.D. (part) - - ⅜	Padstow (part of).	1. Norway chiefly; also timber and pyrites from Brussels, and occasionally gypsum from France. 2. With Wadebridge, five miles up the Camel River.	2	400	M.O.H. to Padstow U.S.D.
2	BARNSTAPLE [March 14th, 1889.]	(Joint Board) "The Barnstaple "Port Sanitary Authority," composed as follows:— Members. Barnstaple U.S.A. - 3; Bideford U.S.A. - 2; Northam U.S.A. - 2; Barnstaple R.S.A. - 3	Barnstaple U.S.D. - - 3/16; Bideford U.S.D. - - 3/16; Northam U.S.D. - - 3/16; Barnstaple R.S.D. - - 7/16	Barnstaple (part of).	1. Chiefly timber from the Baltic. 2. None of any importance.	17	2,081	M.O.H. for Northam U.S.D.
3	*Bridgwater*	The Bridgwater Town Council	Bridgwater U.S.D. (whole); Burnham U.S.D. (whole); Bridgwater R.S.D. (part); Axbridge R.S.D. (part). Expenses borne by Bridgwater U.S.D.	Bridgwater (part of).	1. Baltic, German, Dutch, and French ports (including Hamburg, Harburg, Antwerp, Rotterdam, Havre, Rouen, and Dieppe), the Mediterranean, and South America. *Imports.*—Grain, phosphates, rags, wood pulp, timber, hides, and horns. No emigrant or systematic passenger traffic. 2. —	57	2,924	M.O.H. to Bridgwater U.S.D. As P.M.O.H. 15*l.* per annum.

No.	Port Inspector of of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
1	Harbour Master.	Hawker's Cove, at mouth of Padstow Bay.	At Harbour Cove, near to boarding station, and separated from channel by a small sandbank.	P.S.A. have obtained a cottage at a disused slate quarry, about two miles up the River Camel. It contains two rooms for hospital purposes, and a small room for nurse. Not furnished at time of inspection. Conveyance of patients by boat. Well of, apparently, good water. Excrement to be buried. No disinfecting apparatus or mortuary.	Apparently not in a systematic manner.	Dr. Copeman -	P.S.A. advised by Dr. Copeman to purchase some efficient disinfecting apparatus, and also to furnish their "hospital." The latter piece of advice seems to have been acted upon.
2	P.I. of N. does not act as I. of N. for any other district.	Between the Bar and Appledore Pool.	At Broadsands on the River Taw, opposite Appledore. Mooring station said to have insufficient water at low tide.	No accommodation for isolation. No public mortuary. For disinfection, a brick chamber of local manufacture, heated by gas.	Yes	Dr. Copeman -	P.S.A. advised by Dr. Copeman to acquire and equip a hulk for use as a hospital, and to provide an efficient disinfecting apparatus.
3	I. of N. to Bridgwater U.S.D. As P.I. of N., 30*l.* per annum.	Off Burnham - -	P.S.A. in doubt as to mooring station. The only safe anchorage is stated to be at a spot near the Flat Holm. This, however, is in the Bristol Customs Port. Collector of Customs expresses his intention of sending vessels, if necessary, to the spot in question.	An old powder magazine, situated on the bank of the River Parrett, about five miles below Bridgwater, and near the village of Combwick, has been purchased by P.S.A. for use as an isolation hospital. At time of inspection, however, it was quite unfit for the purpose. It was unfurnished and dirty; unprovided with any suitable entrance; and had no windows, means of heating, water supply, drainage, accommodation for nurses, or separation of the sexes. There was also no mortuary, laundry, or disinfecting apparatus.	Only in a partial manner.	Mr. T. W. Thompson.	The Customs boarding station being at Burnham, some miles from Bridgwater, it had been arranged that in the event of an infected vessel arriving at Burnham, the Customs officer should telegraph to P.M.O.H. to that effect. As, however, the telegraph office closes at 8 p.m., P.S.A. were advised to make special arrangements for the transmission of messages by hand or otherwise during the night. The unsatisfactory character of the "hospital" was pointed out to the Mayor, P.M.O.H., and P. I. of N., to whom it was urged that P.S.A. should provide more suitable isolation accommodation, either alone or conjointly with some other S.A., before next spring; but that in the meantime they should make such alterations in the existing building as could be rapidly carried out, and were necessary to enable them to meet the immediate danger of cholera importation. P.S.A. also advised to appoint an assistant P.M.O.H. at Burnham, to inspect vessels, &c., in the event of the P.M.O.H. not being available.

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WEST COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
4	*Bristol*	The Bristol Town Council	Bristol U.S.D. (whole) - $\frac{12}{15}$ Portishead U.S.D. (whole); Axbridge R.S.D. (part); Barton Regis R.S.D. (part); Bedminster R.S.D. (part).	Bristol (part of).	1. The Baltic, German, Dutch, French, Mediterranean, Black Sea, and American ports. Trade consists of agricultural produce, fruit, wine, spirits, tobacco, &c. No emigrant or systematic passenger traffic. 2. Barge and canal traffic up the River Avon.	862	7,388	M.O.H. to Bristol U.S.D. As P.M.O.H., 50*l.* per annum. There is also an Assistant P.M.O.H. (permanent), and a Second Assistant P.M.O.H. (temporary).
5	*Gloucester*	The Gloucester Town Council	Gloucester U.S.D. (whole) $\frac{100}{100}$ Thornbury R.S.D. (part) - $\frac{11}{100}$ Gloucester R.S.D. (part) - $\frac{11}{100}$ Wheatenhurst R.S.D. (part) - $\frac{1}{100}$ Dursley R.S.D. (part) - $\frac{1}{100}$	Gloucester (part of).	1. The Baltic, German, French, Black Sea, and American ports. Imports of corn, timber, sugar, and general merchandise. 2. Barges go up the Severn to Stourport. From Worcester the traffic branches off along the Worcester and Birmingham and Shropshire canals. A quantity of sugar goes thus from Hamburg to Birmingham. Canal boats said to be regularly inspected by Inspector of Canal Boats.	329	1,331	M.O.H. to Gloucester U.S.D. As P.M.O.H., 50*l.* per annum.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
4	There are two P.I.'s of N.	In the ordinary way vessels are boarded by Customs Officers either in King Road, at the entrance to the docks, or in the river. During the present emergency all vessels are boarded in King Road.	In King Road - - Hospital kept in readiness; but in several respects unsatisfactory. Washington Lyon disinfecting apparatus at U.S.A.'s hospital up the river.	Wooden hospital at Avonmouth. With allowance of 2,000 cubic feet per patient, it would accommodate eight patients. Laundry and mortuary in separate brick building. Bristol Company's water. Drainage into tidal creek. Patients would be conveyed from ships to hospital in steam-tug temporarily hired by P.S.A.	Yes	Mr. T. W. Thompson.	It is anticipated that the site of the present hospital will soon be required for dock extension, and it will then be necessary for another hospital to be provided.
5	Harbour Master at Sharpness. As P.I. of N., 10*l.* per annum.	1. At King Road; 2. At Sharpness. Pilots have orders to stop all vessels from infected ports at King Road (Bristol Customs port).	Mooring station fixed at Northwick Oase.	P.S.A. possess two wooden isolation hospitals, one at Gloucester, and one at Sharpness; the latter always kept in readiness, the former being put in readiness at time of inspection. Each would accommodate five or six patients. Patients could be brought near to both hospitals by water. Sharpness Hospital supplied with drinking water by a well. Water would be sent to Gloucester Hospital from the town. No mortuary or disinfecting apparatus at P.S.A.'s hospitals; but hot-air chamber and mortuary at U.S.A.'s hospital.	Vessels said to be inspected; but no record kept.	Mr. T. W. Thompson.	The Gloucester P.S.A. also have an arrangement with the Bristol P.S.A. for inspection (at an agreed scale of fees) of vessels, coming to Gloucester, by the Bristol P.M.O.H. in King Road. The Bilge-water Order is being attended to at Sharpness as regards the pumping out of bilges and water cisterns, but P.S.A. do not provide a fresh supply of drinking water to vessels, as the Gloucester supply is said at present to be barely sufficient for the needs of the U.S.D. It was pointed out to them at the conference, that in cases in which they require vessels to discard their drinking water before coming into dock, it was their duty, under the Order, to provide such vessels with a fresh supply. P.S.A. were also advised to appoint an additional temporary P.I. of N. to watch vessels in Gloucester Dock.

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WEST COAST—*continued.*

Port Sanitary Districts inspected during 1892; with certain specified Particulars of Shipping Trade and Sanitary Administration—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port: with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
6	**CHEPSTOW** - - [Sept. 22nd, 1887.]	The Chepstow Local Board -	Chepstow U.S.D. - - 13/13 Chepstow R.S.D. (part); Newport R.S.D. (part).	Gloucester (part of).	1. Practically no foreign trade. The last vessel coming from foreign arrived about three years ago. Coasting trade with Bristol, Cardiff, and other ports along the coast. 2. The River Wye.	1	90	M.O.H. to Chepstow U.S.D. No special remuneration as P.M.O.H.
7	**NEWPORT** - - (*Monmouth.*) [May 9th, 1883.]	The Newport Town Council -	Newport U.S.D. (whole); Cardiff R.S.D. (part); Newport R.S.D. (part). All contribute towards port expenses.	Newport (whole of).	1. France, Germany, Belgium, and Holland (including Hamburg and Rotterdam): Also the Baltic, Norway, Greece, and Morocco. Imports mainly timber and iron ore. 2. Monmouthshire Canal. Canal boats said to be regularly inspected by Canal Boats Inspector.	1,149	6,866	M.O.H. to Newport U.S.D. As P.M.O.H., 50*l.* per annum.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
6	I. of N. to Chepstow U.S.D. No special remuneration as P.I. of N.	None. No Customs or Coastguard Officer at Chepstow. A man living at Chepstow has, however, been commissioned to inform Customs Officer at Gloucester of the arrival of any foreign ship at Chepstow. Chepstow is also visited each quarter by Customs Officer at Lydney.	No mooring station arranged.	The same as in 1884, viz., an old house near the Wye, at Chepstow. It was in a dirty and dilapidated condition at time of inspection. Bedding, however, is kept in it in readiness, and a caretaker resides on the premises. Town water within 100 yards. No drainage. A mourning coach for ambulance. No disinfecting apparatus or mortuary.	No	Mr. T. W. Thompson.	The unsatisfactory condition of the hospital pointed out to the Chairman of P.S.A. and M.O.H., who were urged to at least see to its being cleansed and put in a habitable condition. The duty of the P.S.A. as regards the inspection of vessels under the Public Health Acts was also pointed out.
7	P.I. of N. gives whole time to port work. Salary, 91*l.* per annum.	Opposite the watch-house at entrance to Alexandra Dock in River Usk.	Mooring station fixed near "The Spit," in Newport Deeps.	Small wooden "cholera" hospital in isolated position on shore, consists of one ward for four patients. Small cottage on site for caretaker or nurse. Hospital warmed by hot-water pipes. Water sent from the town in a cart. No drainage. Excrement would be buried. Hospital kept in readiness, and there is room for extension. Ambulance kept at Town's Yard. No disinfecting apparatus or mortuary for cholera cases.	Vessels said to be inspected.	Mr. T. W. Thompson.	In addition to the small "cholera" hospital already mentioned, P.S.A. possess another hospital (two old houses) which they use for ship-borne cases of disease other than cholera. The absence of any arrangements for separating the sexes at the cholera hospital, also the deficiency of administrative accommodation there, and the absence of a mortuary were pointed out to Chairman and P.M.O.H.

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WEST COAST—*continued.*

Port Sanitary Districts inspected during 1892; with certain specified Particulars of Shipping Trade and Sanitary Administration—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891.		Port Medical Officer of Health.
						From Foreign.	Coastwise.	
8	**CARDIFF** - - [April 8th, 1882.]	The Cardiff Town Council -	Cardiff U.S.D. (whole); Penarth U.S.D. (whole); Cardiff R.S.D. (part). All contribute towards port expenses.	Cardiff (part of).	1. Baltic, German, French, Spanish and British ports. 2. By Rivers Rumney, Taff, and Ely, but no traffic up any of these. Considerable canal boat traffic to and from docks on Glamorganshire Canal. Canal boats bring down coal and take up general goods from English ports. They are said to be inspected by Canal Boats Inspector.	3,450	9,379	M.O.H. to Cardiff U.S.D. As P.M.O.H., 200*l.* per annum.
9	**SWANSEA** - - [Oct. 5th, 1887.]	(Joint Board) "The Swansea "Port Sanitary Authority," composed as follows:— Members. Swansea U.S.A. - 8 Aberavon U.S.A. - 1 Neath U.S.A. - - 1 Briton Ferry U.S.A. - 1 Margam U.S.A. - - 1 Oystermouth U.S.A. - 1 Bridgend and Cowbridge R.S.A. - - 1 Swansea R.S.A. - - 1 Neath R.S.A. - - 1	Swansea U.S.D. (whole); Aberavon U.S.D. (whole); Neath U.S.D. (whole); Briton Ferry U.S.D. (whole); Margam U.S.D. (whole); Oystermouth U.S.D. (whole); Bridgend and Cowbridge R.S.D. (part); Swansea R.S.D. (part); Neath R.S.D. (part). All contribute towards port expenses.	Swansea (part of).	1. Baltic and Scandinavian ports generally. North of France, Spain, European, Asiatic, and African ports in Mediterranean, North and South America. Increase in American trade since 1884. 2. None.	1,377	4,519	M.O.H. to Swansea U.S.D. As P.M.O.H. he is assisted by M.Os.H. of Briton Ferry, Aberavon, and Neath U.S.D.'s, and Dr. James of Porthcawl. These gentlemen receive a fee of 1*l.* 1*s.* for each visit.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities. Customs Boarding Station.	Arrangements concerning Customs Authorities. Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.	Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
8	Two permanent P.I.'s of N., who devote their whole time to port work, at salaries of 35*s.* and 30*s.* a week respectively. During the danger of cholera importation an Urban I. of N. was also told off to assist the P.I.'s of N.	The basins at the entrance to the Cardiff and Penarth Docks and the Glamorganshire Canal. (*See* Remarks.)	Mooring station fixed with approval of Collector of Customs, near the Flat Holm Island.	Small brick isolation hospital on Flat Holm Island. It contains one ward and nurses' duty room. With an allowance of 2,000 cubic feet the ward would only accommodate two patients. P.S.A. also possess a marquee and bell-tent for erection on Flat Holm Island, but at time of inspection they were old and unfit for use. There is a small hotel on the island which would be given up to P.S.A. as accommodation for hospital staff, if necessary. No disinfecting apparatus or mortuary at Flat Holm Island.	Yes	Mr. T. W. Thompson.	The fact that in the usual way vessels are not boarded by the Customs officers until they have entered the dock basin is extremely unsatisfactory from the point of view of the Cholera Regulations. To overcome this disadvantage the P.S.A. hired a steam tug for the purpose of enabling their officers to meet vessels in the Channel, and the Customs Authorities told off an officer to accompany the P.S.A.'s tug and to board vessels before their arrival at the docks. As a result of the conference with the Chairman and officers of the P.S.A. it was decided to appoint an Asst. P.M.O.H.; to afford further assistance to the P.I.'s of N. by appointing a clerk to carry on their office work; and to despatch at once a nurse to the cholera hospital on the Flat Holm Island and to retain another in case of need. It was also agreed to purchase a new marquee and bell-tent to be erected at Flat Holm forthwith. P.S.A. should, however, be provided with more extensive and satisfactory isolation accommodation of a permanent kind.
9	Two P.I.'s of N. for Swansea (one being temporary for cholera emergency); one each for Port Talbot and Porthcawl; and one (additional) for Neath and Briton Ferry conjointly recommended by P.M.O.H., but not appointed at time of inspection.	During cholera emergency the Customs boarding station has, upon suggestion of P.M.O.H., been fixed at the Mumbles.	Stated to be impracticable to fix any definite mooring station, but vessels will "be placed as tide "and wind may "serve."	Hospital conveniently situated in well-isolated position on foreshore. Consists of four huts with accommodation for 14 patients in all, and two separate blocks for staff. Tent to accommodate 30 patients in preparation. Town water laid on. Slop drainage on to beach. Earth closets. Horse ambulance, and also light hand or pony ambulance. Patients brought to pier by boat, but P.S.A. have no boat of their own. Washington Lyon's steam disinfector. Mortuary at docks.	Yes	Dr. Downes	P.S.A. have provided a steam-tug for the use of their officers and the Customs officials. P.M.O.H. advised by Dr. Downes to visit all vessels from infected ports. He agreed to do so. Arrangements generally satisfactory.

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WEST COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified particulars of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port: with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891.		Port Medical Officer of Health.
						From Foreign.	Coastwise.	
10	MILFORD - - (*Pembroke.*) [April 24th, 1878.]	(Joint Board) "The Milford "Port Sanitary Authority," composed as follows:— Members. Pembroke U.S.A. - 3 Haverfordwest U.S.A. - 2 Milford U.S.A. - - 1 Haverfordwest R.S.A. 3 Narberth R.S.A. - 1 Pembroke R.S.A. - 3	Pembroke U.S.D. (whole); Haverfordwest U.S.D. (whole); Milford U.S.D. (whole); Haverfordwest R.S.D. (part); Narberth R.S.D. (part); Pembroke R.S.D. (part). All contribute towards port expenses.	Milford (part of).	1. Chiefly with the Baltic (timber and ice), but vessels from other parts often put in under stress of weather, &c. During the last two years a large deep-sea fishing trade, similar to that at Grimsby, has developed. The fishing vessels occasionally visit French ports to sell fish. 2. No canals. No navigable river beyond tidal portion.	52	4,282	M.O.H. for Milford U.S.D. and R.S.D. As P.M.O.H., 15*l.* per annum. Asst. P.M.O.H. appointed for cholera emergency.
11	CARDIGAN - - [Sept. 28th, 1887.]	The Town Council of Cardigan	Cardigan U.S.D. - - $\frac{12}{15}$ Cardigan R.S.D. (part).	Cardigan (part of).	1. Foreign trade small. Timber from the Baltic. Considerable traffic with Bristol and Welsh ports, and some with Ireland. 2. None.	None	262	M.O.H. to Cardigan U and R.S.D.'s As P.M.O.H., 4*l.* per annum.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
10	I. of N. to Milford U.S.D. As P.I. of N., 15*l.* per annum.	Off Stack Rock in the harbour just below Old Milford.	Off Popton Point near the mouth of Angle Bay. Approved by Queen's Harbour Master.	Unsatisfactory. A detached building with two small wards for four, or perhaps six, patients in all. Caretaker's house, but no accommodation for nurses. Water supply from rain-water tank or public dipping well 100 yards distant. Earth closets. Excreta buried. Slops disposed of on garden endangering rain-water tanks. No ambulance, disinfecting apparatus, mortuary, or washhouse. Hospital, which is near Milford Haven, badly situated, being also near Board school, &c., and patients coming to it would pass through part of town. Hospital, however, kept in readiness.	Not systematically.	Dr. Downes	Customs officer advised by Dr. Downes to board all vessels before they communicate with the shore. I. of N. urged to make systematic inspection of vessels. Dr. Downes also impressed upon P.S.A. the importance of making proper arrangements for isolation and for the conveyance of patients to hospital.
11	Borough Surveyor and I. of N. to U.S.D. As P.I. of N., 15*l.* per annum.	On the bar at the mouth of the river.	Mooring station said by Clerk to be fixed in the bay opposite Penrhyn Castle. Good anchorage, but would probably not be safe in foul weather from N.W. Vessels would then have to seek shelter under Cardigan Island. This mooring station apparently has not been approved of by Customs officer.	No hospital. P.M.O.H. is authorised to hire a house if necessary. No disinfecting apparatus. No mortuary.	Yes	Dr. Downes	P.S.A. urged by Dr. Downes to make proper provision for the isolation of persons suffering from infectious diseases.

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WEST COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified particulars of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891.		Port Medical Officer of Health.
						From Foreign.	Coastwise.	
12	CARNARVON - - [Aug. 15th, 1889.]	The Carnarvon Town Council.	Carnarvon U.S.D. - - ⅔ Carnarvon R.S.D. - - ⅓ Bangor and Beaumaris R.S.D. 0	Carnarvon (part of).	Hamburg (with slates), America, Norway, and Sweden. Coals from Runcorn.	9	778	P.M.O.H. does not act as M.O.H. to any other district.
13	BEAUMARIS - - [Jan. 1st, 1889.]	(Joint Board) "The Beaumaris Port Sanitary Authority," composed as follows:— Members. Bangor U.S.A. - - 3; Beaumaris U.S.A. - 1; Conway U.S.A. - - 3; Dwygyfylchi U.S.A. - 1; Menai Bridge U.S.A. - 1; Bangor and Beaumaris R.S.A. - 2	Bangor U.S.D. - - 1/15 Beaumaris U.S.D. - - 3/15 Conway U.S.D. - - 6/15 Dwygyfylchi U.S.D. - 1/15 Menai Bridge U.S.D. - 1/15 Bangor and Beaumaris R.S.D. (part) - - 1/15	Beaumaris (part of).	1. The Baltic and coasting trade. 2. Through Menai Straits to Carnarvon.	14	1,325	P.M.O.H. does not act as M.O.H. for any other district. As P.M.O.H. a retaining fee of only 2*l.* 2*s.* and 3*s.* for each visit.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
12	I. of N. to Carnarvon U.S.D. As P.I. of N., 20*l.* per annum.	At Brynglas off Carnarvon.	Mooring station in Aberffraw Bay, about 12 miles from Carnarvon. It is apparently in the Beaumaris Customs Port.	Hospital, for joint use of Port and Urban S.A.'s, situated about 1½ miles outside the town. Contains 20 beds, half of which are ready for use (for cholera?). Town water. Drainage into leaky cesspool, so that its fluid contents must gradually escape and contaminate the soil near and under the hospital. Hot-air disinfecting apparatus and mortuary at hospital. Also mortuary at Quay.	Yes	Dr. Copeman	P.S.A. advised by Dr. Copeman to purchase an efficient disinfecting apparatus and ambulance stretcher.
13	Surveyor and I. of N. to Colwyn U.S.D. Clerk to P.S.D.	The cross roads, N.E. of Beaumaris.	Mooring station arranged by P.M.O.H. just S.W. of boarding station (? off Penrhyn), but not officially agreed upon between P.S.A. and Customs authorities.	P.S.A. possess a hospital ship arranged to accommodate four or, perhaps, six patients. It is at present moored at Bangor Dock, but if in use would be moored S.W. of Beaumaris. It is not kept in readiness. Water would be sent to it from Bangor Waterworks. P.S.A. have no boat for conveyance of patients or P.M.O.H. Arrangements made for use of mortuary at Bangor Infirmary. Neither P.S.A. nor U.S.A. have any disinfecting apparatus.	Only occasionally; no record kept.	Dr. Copeman	The district being extensive, vessels are sometimes not boarded by Customs officers for two or three days, as these officers only have one small rowing boat. It has, therefore, been arranged that the pilots at Penmaen Station shall receive a fee of 2*s.* 6*d.* for giving to P.M.O.H. information of the arrival of a vessel from foreign. The Bangor U.S.A. propose erecting an isolation hospital outside Bangor, and also providing there a Goddard and Massey's steam disinfector. Dr. Copeman advised that the hospital ship should at once be put in readiness to receive patients, and that a boat, preferably a steam launch, should be provided for port sanitary purposes. He also advised that the proposed steam disinfector should be at once erected and in a more convenient situation than that of the contemplated hospital. [Port Deganway seems to do a larger foreign trade than Bangor and Beaumaris, and is apparently neglected by P.S.A. Query whether a Deputy P.M.O.H. and Deputy P.I. of N. should not be appointed at Deganway or Conway.]

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WEST COAST—*continued.*

Port Sanitary Districts inspected during 1892; with certain specified Particulars of Shipping Trade and Sanitary Administration—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
14	CHESTER - - [March 28th, 1888.]	(Joint Board) "The Chester "Port Sanitary Authority," composed as follows:— Members. Chester U.S.A. - - 3 Flint U.S.A. - - 2 Rhyl U.S.A. - - 1 Hawarden R.S.A. - 1 Holywell R.S.A. - - 5	Chester U.S.D. - - 1/30 Flint U.S.D. - - 2/30 Rhyl U.S.D. - - 1/30 Hawarden R.S.D. (part) - 1/30 Holywell R.S.D. (part) - 3/30 St. Asaph R.S.D. (part); Holywell U.S.D. (part); Wirral R.S.D. (part); Chester R.S.D. (part).	Chester (whole of).	1. Timber from Norway, the Baltic, and America. Iron from Spain, Beaumaris, and Furness. Gravel to Rhyl from Liverpool. 2. There is no trade above Chester on the Dee, nor above the bridge at Rhyl on the River Clwyd. At Chester the Dee communicates by locks with the Ellesmere Canal.	56	2,601	M.O.H. to the Flint U.S.D. As P.M.O.H., 25*l.* per annum.
15	LIVERPOOL - - [June 11th, 1874.]	The Liverpool Town Council -	Per cent. Liverpool U.S.D. - 85 Birkenhead U.S.D. - 7 Bootle-cum-Linacre U.S.D. - — Southport U.S.D. - - — Birkdale U.S.D. - - — Bromborough U.S.D. - — Garston U.S.D. - - 1·55 Little Crosby U.S.D. - — Great Crosby U.S.D. - — Higher Bebington U.S.D. 0·11 Lower Bebington U.S.D. - 0·10 Toxteth Park U.S.D. - 1·54 Tranmere U.S.D. - - 1·70 Wallasey U.S.D. - - 2·50 Waterloo-with-Seaforth U.S.D. - - — Ormskirk R.S.D. (part) - — Prescot R.S.D. (part) - — West Derby R.S.D. - — Wirral R.S.D. (part) - —	Liverpool (whole of).	All parts of the world - - 2. With Runcorn on the Mersey. Eventually with Manchester.	4,597	13,240	M.O.H. to Liverpool U.S.D. As P.M.O.H., 100*l.* per annum. The Asst. M.O.H. to Liverpool U.S.D., acts as asst. P.M.O.H.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
14	Harbour Master at Mostyn. As P.I. of N., 30*l.* per annum.	In Mostyn Deep	In Mostyn Deep	P.S.A. possess a small hospital for four patients at Mostyn. It is situated on a peninsula of slag from ironworks and is well isolated, except that it is passed within about 16 feet by a line of rails used for conveying slag to the extremity of the peninsula. Mostyn town water laid on. Excrement to be disposed of (after disinfection) in pervious cesspool in the slag. Patients could be brought within a few feet of hospital by boat. Nurses at Chester Infirmary retained for duty at Mostyn Hospital, if required. Small mortuary at hospital. No disinfecting apparatus.	Yes	Dr. Bulstrode.	There is no Customs officer at Rhyl, but the Coastguard stationed there would, it is said, at once communicate with the Customs officer at Mostyn, and the P.M.O.H. at Flint, in the event of his meeting with an infected vessel. The authority of the Coastguard to act under the Cholera Regulations becomes, however, an important question. But assuming his authority to detain an infected vessel at Rhyl, much time might elapse, especially at night, before the arrival of the P.M.O.H., and it would thus seem desirable that a Deputy P.M.O.H. should be appointed at Rhyl. The present hospital only affords accommodation for four patients of one sex and suffering from the same disease. The use of this hospital for cholera cases is objected to by the residents of Mostyn.
15	Only one P.I. of N.	None fixed. Vessels frequently boarded at entrance to docks.	Mooring station fixed in the "Sloyne" Roads, opposite the port hospital.	Iron hospital for 24 patients at New Ferry on Cheshire bank of Mersey. There is a lodge for caretaker and four nurses; also a kitchen block and mortuary, but no laundry and no disinfecting apparatus. Plenty of room for extension. Hospital only accessible by river at high water. P.S.A. have no launch. Means of access by land so bad that it would be almost impossible to get the ambulance to the hospital without accident. There is a mortuary and post-mortem room near the landing stage.	Partially	Dr. Barry	General arrangements inadequate. Dr. Barry urged—1. A considerable increase in the inspectorial staff, and the acquirement of Port Sanitary Offices near the Customs Office, in order to avoid delay in dealing with ships entering the port. 2. The making of regulations under section 123, Public Health Act, 1875. 3. The provision of a laundry and proper disinfecting apparatus at the hospital. 4. The provision of a steam launch with ambulance accommodation. 5. That a proper boarding station for vessels from infected ports should be defined. 6. That during cholera prevalence a sufficient number of Assistant Port Medical Officers of Health should be appointed to ensure the boarding and inspection of all vessels from infected ports. Since Dr. Barry's visit two temporary Assistant Port Medical Officers of Health have been appointed for the purpose of inspecting shipping.

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WEST COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.†	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Port Medical Officer of Health.
16	PRESTON [June 5th, 1888.]	The Preston Town Council	Preston U.S.D. - 12/16 Blackpool U.S.D.; Lytham U.S.D.; St. Anne's-on-Sea U.S.D.; The Fylde R.S.D. (part); Ormskirk R.S.D. (part); Preston R.S.D. (part).	Preston (nearly all).	1. North America chiefly, but a few vessels come from the Baltic. Practically no shipping at Lytham now as the dock is silted up. 2. Practically none. The River Douglas joins the Liverpool Canal, but there is said to be no traffic up it in connexion with sea-going vessels.	6	258	M.O.H. to Preston U.S.D. As P.M.O.H., 10*l.* per annum.
17	FLEETWOOD [Jan. 18th, 1888.]	The Fleetwood Improvement Commissioners.	Fleetwood U.S.D. (whole) - 16/16	Fleetwood (part of).	1. Baltic, Antwerp, Mediterranean, Black Sea, Canada, Norway, and Sweden. A few vessels from French ports. 2. Only the River Wyre, which is navigable about 4¼ miles up. A few ships, and occasionally one from foreign, go up this river to a bone mill. Such vessels are boarded by the Customs Officers before going up the river.	213	1,502	M.O.H. to Fleetwood U.S.D. As P.M.O.H., 20*l.* per annum. An Assist. P.M.O.H. also temporarily appointed to ensure the boarding of all vessels from infected ports.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
		Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
16	A clerk in the Dredging Department. The four urban I.'s of N. also formally appointed P.I.'s of N.	In the basin at the entrance to the dock.	At the time of inspection it was proposed to moor all vessels in the dock, no safe anchorage outside being availalable, it was said.	No port hospital. U.S.A. have an arrangement by which upon payment of 1*l.* 1*s.* a case they can send patients to the isolation wards of the Royal Infirmary. Hot-air disinfecting apparatus and mortuary at Town's yard.	Vessels said to be inspected by Urban I. of N., but no record kept.	Mr. T. W. Thompson.	The undesirability of mooring infected vessels in the dock was pointed out at the conference with the officers of the P.S.A., who, however, urged the difficulty of finding safe anchorage elsewhere. Ultimately it was arranged that an alternative mooring station for large steam vessels should be fixed at Nelson Buoy,‡ outside the mouth of the Ribble: such vessels being at liberty to run elsewhere for shelter, if necessary, on condition of intimation of their intention of doing so being given to P.S.A. Small vessels still to be moored in the dock, but a better mooring station for them should be found if possible. The need for more satisfactory arrangements for isolating cholera patients was also pointed out. U.S.A., it appears, possess a large Ducker Hospital, and P.M.O.H. undertook to advise that a portion of this (with a mortuary) should be erected on a convenient site near the dock.
17	I. of N. to Fleetwood U.S.D. As P.I. of N., 30*l.* per annum.	The appointed boarding station is off Knott End, but in ordinary times vessels are usually boarded at entrance to dock on account of strong tide and rough weather at Knott End. At time of inspection, however, Customs Officer had undertaken to accompany P.M.O.H. in steam tug to meet vessels in Lune Deep.	Mooring station appointed near No. 1 Buoy in Lune Deep.	No means of isolation. The Harbour Authority has temporarily provided P.S.A. with a site for a cholera hospital, but up to time of inspection P.S.A. were relying on their ability to erect a wooden hospital at short notice, if required. The Harbour Authority were prepared to extend their water main to the site. Patients could be brought up the river by boat. U.S.A. possess a Goddard and Massey's steam apparatus, and there is a mortuary at the Town's yard.	Yes	Mr. T. W. Thompson.	P.S.A. have arranged for hire of a steam tug for the conveyance of their officers. General arrangements for detecting seaborne cholera satisfactory, but no proper arrangements for dealing with cases when detected. P.S.A. urged to provide, at once, accommodation which should be in actual readiness for the reception and isolation of persons suffering from ship-borne infectious diseases.

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‡ This is outside Preston Customs Port, and according to a map, since forwarded by P.S.A., No. 1 Buoy, which is in P.S.A.'s District, has apparently been selected instead.

WEST COAST—*continued.*

PORT SANITARY DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	District.*	Authority Administering the Port.	Sanitary Districts included (wholly or in part) in the Port; with the Proportion (if any) contributed by each to Port Expenses.	Customs Port in which the Port Sanitary District is situated.	1. Principal Trade with— 2. Inland Water Communication.	Vessels Inwards in 1891.		Port Medical Officer of Health.
						From Foreign.	Coastwise.	
18	LANCASTER - [Nov. 26th, 1891.]	The Lancaster Town Council -	Lancaster U.S.D. (whole); Lancaster R.S.D. (part). Both contribute to port expenses.	Lancaster (part of).	1. Hamburg, Antwerp, Rouen, Baltic, America, Norway, and Sweden. 2. The Lancaster and Kendal Canal. Canal boats said to be inspected.	36	171	M.O.H. to Lancaster U.S.D. As P.M.O.H., 20*l.* per annum.
19	WORKINGTON [Dec. 31st, 1887.]	(Joint Board) The Workington Port Sanitary Authority, composed as follows:— Members. Workington U.S.A. - 6 Cockermouth R.S.A. - 2 Whitehaven R.S.A. - 2	Workington U.S.D. (whole) $\frac{20}{20}$ Cockermouth R.S.D. (part) $\frac{2}{20}$ Whitehaven R.S.D. (part) $\frac{1}{20}$ [Since the making of the Order in 1887, Harrington, which had hitherto formed a part of the Whitehaven R.S.D., has been constituted an Urban Sanitary District. As a consequence of this, the Harrington U.S.A. are apparently finding the two members and the contribution of $\frac{1}{20}$ previously found by the Whitehaven R.S.A.]	Workington (part of).	1. Almost exclusively coasting trade, but a few vessels from Bilbao. 2. None.	3	1,596	P.M.O.H. does not act as M.O.H. to any other district. As P.M.O H., 10*l.* per annum.

No.	Port Inspector of Nuisances.	Arrangements concerning Customs Authorities. Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.	Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
18	I. of N. to Lancaster U.S.D. As P.I. of N., 10*l.* per annum.	A short distance outside the entrance to Glasson Dock.	Mooring station fixed between Nos. 1 and 2 Buoys at the mouth of the Lune off Fleetwood.	U.S.A. possess an isolation hospital, but it is not proposed to take cholera patients to it. For this purpose a site has been offered to and accepted by P.S.A., but nothing erected upon it, reliance being placed upon ability to erect tents in case of need. This site is on the bank of the Lune about 2 miles above Glasson Dock, and is well isolated. Excreta would be buried. Water would be sent from Lancaster either by river or rail, a station being adjacent.	Vessels said to be inspected.	Mr. T. W. Thompson.	Pilotage Board have instructed pilots to bring up all vessels from infected ports at the mooring station. At a conference with P.S.A. it was pointed out that reliance should not be placed upon ability to erect tents for the isolation of cholera cases, but that some accommodation should be actually in readiness beforehand.
19	P.I. of N. does not act as I. of N. for any other district. As P.I. of N., 30*l.* per annum.	There is no Customs officer stationed either at Workington or Harrington which is in this district. These places are, however, visited daily by an officer from Maryport. In the ordinary way he boards vessels at entrance to harbour, but during danger of cholera, if he heard of a vessel coming from foreign he would be on the alert and board her outside.	It was proposed owing to the exposed character of the coast, to send infected vessels to Silloth Roads—a distance of 15 miles or so, and in another Customs Port. (*See* Remarks.)	P.S.A. possess a small wooden hospital in fairly isolated position at "Merchant's Quay." It contains two small wards having cubic capacity of 2,000 and 2,600 feet respectively, also a small room for nurse. There is no mortuary at this hospital. Patients could be brought by boat up the river. Water would be sent from the town. Excrement would be disinfected and burned. There is a hot-air disinfecting apparatus at U.S.A.'s hospital.	Yes	Mr. T. W. Thompson.	P.S.A. advised to provide increased isolation accommodation, and also to erect a mortuary near their hospital. As regards isolation accommodation, P.S.A. seemed inclined to erect a small hospital at Harrington for any cases brought to that dock, and this seems desirable if a suitable site can be found there. In view of the difficulty of finding safe anchorage for all weathers in their own district, P.S.A. were advised to moor small vessels in the harbour, and larger ones outside—the latter being at liberty to run elsewhere for shelter, if necessary, provided they signalled their intention of doing so and their proposed destination.

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EAST COAST.

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION.

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
1	BERWICK - ON - TWEED U.S.D.	Berwick -	Baltic ports chiefly; also with Spain, Belgium, and South America.	—	None - -	67	229	Urban M.O.H. - -	Urban I. of N.
2	AMBLE U.S.D. -	North Shields	All ports from Brest northwards to the Baltic. Coal outwards and ballast inwards.	—	None - -	307	433	Urban M.O.H. - -	Surveyor, Assistant Overseer, and I. of N. to Amble U.S.D.
3	NEWBIGGIN - BY - SEA U.S.D.	North Shields	Practically none. Occasionally a French fishing boat puts in under stress of weather.	Apparently none.	None - -	None -	None -	Urban M.O.H. - -	Urban I. of N.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
1	At Can Rock, on south side of the Tweed.	Mooring station fixed. (*See* Remarks.)	For port purposes S.A. possess a small hospital, giving accommodation for eight patients. Two wards. No washhouse or mortuary. Hospital well isolated and conveniently situated, and there is room for extension on site. Hand ambulance provided. Town water supply. Excrement disposal by earth closets. Portable steam disinfector.	No	Dr. Barry - -	Fairly satisfactory, except as regards want of laundry and mortuary at hospital. Letter addressed to S.A. by the Board on September 15th, 1892, inquiring as to action taken to remedy these defects. Reply from S.A., dated September 16th, 1892, stated that the erection of laundry and mortuary at the hospital was being proceeded with. It also stated that a new and more convenient "mooring station" had been fixed, with approval of the local Chief Officer of Customs, above "Can Rock."
2	Anywhere within the pier heads, practically about 200 yards within.	Mooring station fixed at a point about 100 yards from the north bank in the Slake. Not satisfactory, as vessels are dry at low water.	No hospital or proper disinfecting apparatus or mortuary. A stretcher for conveyance of patients has been provided.	No	Dr. Barry - -	S.A. urged by Dr. Barry to select a more suitable mooring station, and to at once make provision for the isolation of persons suffering from infectious disease. S.A. have since selected a mooring station near the north bank of the Slake. (December 28th, 1892.) No information received since inspection as to provision by S.A. of isolation hospital.
3	The Coastguard would board any vessel in the roads before allowing persons to land.	The open roadstead -	No hospital; no proper disinfecting apparatus; no mortuary.	No	Dr. Barry - -	The cholera regulations would be carried out except as regards the isolation of persons suffering from that disease. S.A. disinclined to provide hospital on the ground that they have no shipping trade, foreign or coastwise. Letters addressed by the Board to S.A., on Sept. 23rd, 1892, urging the provision of isolation accommodation lest in the event of cholera reaching this country it should break out at Newbiggin.

EAST COAST—*continued.*

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION.

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
4	SEAHAM HARBOUR U.S.D.	Sunderland	France, Spain, Antwerp, Sweden. Chiefly export of coal, ships returning in ballast. A small steamer plies weekly between Antwerp and Seaham harbour.	London	None	83	1,246	Urban M.O.H.	Surveyor, Collector, and I. of N. to U.S.D.
5	WHITBY U.S.D.	Whitby	The Baltic	—	None	6	592	Urban M.O.H.	Urban I. of N.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 26th, 1890.				
4	In the harbour, questions put from the pier head. Arrangements will be made for questions to be put in the roads.	Mooring station fixed on south side of the tidal dock.	S.A. possess a wooden building, giving accommodation for four beds. It abuts on the south pier, and is well isolated. Water supply from the town. Drainage into the sea. This building has recently been put in repair and furnished. No mortuary or proper disinfecting apparatus.	No	Dr. Barry ·	Arrangements satisfactory so far.
5	At the entrance to the harbour.	Middle of inner harbour in the widest part of the river.	The S.A. possess a two-bedded cottage but it is not conveniently situated for the port. Practically no isolation accommodation for port cases. No ambulance, disinfecting apparatus, or mortuary.	No	Dr. Barry ·	S.A. urged by Dr. Barry to at once provide an isolation hospital, ambulance, mortuary, &c., for the purpose of enabling them to carry out the Cholera Orders.

EAST COAST—*continued.*

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessel Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
6	SCARBOROUGH U.S.D.	Scarborough -	Small trade with Norway and Sweden. French fishing boats call also.	Fishing trade	None - -	31	338	Urban M.O.H. - -	Urban I. of N.
7	BRIDLINGTON U.S.D.	Hull - -	Riga (timber) and Stockholm	Fishing trade	None - -	7	352	Urban M.O.H. at salary of 50*l.* per annum; also acts for Bridlington R.S.D.	Urban I. of N., who is also Surveyor to U.S.D.
8	CLEETHORPES-WITH - THRUNSCOE U.S.D.	Grimsby -	None. The water is so shallow that it is impossible to effect a landing from any vessel of greater draught than a small rowing boat.	None	None - -	—	—	Urban M.O.H., who acts for Grimsby U.S.D.	Urban I. of N.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
6	At the mouth of the harbour.	No mooring station fixed at time of inspection.	The S.A. possess an infectious diseases hospital for the town, but it is not suitably situated for port cases. Ransome's disinfecting apparatus. No mortuary.	No	Dr. Barry - -	S.A. advised by Dr. Barry to fix mooring station, subject to approval of Chief Officer of Customs; to make immediate provision for the isolation of infectious cases brought to the port; and to provide a mortuary and an ambulance. At a subsequent visit Dr. Barry ascertained that the S.A., acting on his suggestions, had fixed a mooring station and provided isolation accommodation.
7	Inside the harbour. Vessels coming from foreign would be hailed outside.	No mooring station fixed.	The S.A. have no isolation accommodation. They were apparently relying upon an arrangement with the Guardians for the use of the infectious wards at the workhouse. No ambulance or mortuary, and no provision for disinfection beyond a Nelson's stove at the workhouse.	No	Dr. Barry - -	S.A. advised to fix mooring station and provide isolation accommodation. Dr. Barry understands that since his visit a mooring station has been fixed and buoys placed. Also that S.A. have decided to make suitable provision for isolation, and to provide an ambulance. It is a matter of complaint at Bridlington, Dr. Barry reports, that there are no licensed pilots at the port, and that the pilots are under no jurisdiction of any sort.
8	No boarding station -	No mooring station -	No isolation accommodation or disinfecting apparatus.	—	Dr. Copeman -	General sanitary arrangements of Cleethorpes reported by Dr. Copeman as very faulty. Detailed report by M.O.H. as to sanitary circumstances asked for by the Board on Sept. 6th, 1892, and supplied in October 1892. M.O.H. states, *inter alia*, that "it has been decided" to erect a permanent isolation hospital.

EAST COAST—*continued.*

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Medical Officer of Health.	Inspector of Nuisances.
9	WALTON-ON-THE-NAZE U.S.D.	Harwich and Colchester.	None	None. The only vessel landing people is a pleasure steamer.	—	—	—	Urban M.O.H.	Urban I. of N.
10	GREAT CLACTON U.S.D.	Colchester	None	No shipping trade. Pleasure steamers from London and Harwich land passengers.	—	—	—	Urban M.O.H. who also acts for the Tendring, Lexden, and Winstree R.S.D.'s.	Urban I. of N.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
9	None	None	None. No disinfecting apparatus. A good mortuary recently built.	—	Dr. Fletcher	S.A. urged by Dr. Fletcher to provide isolation accommodation at once. S.A. instructed their clerk to write for permission to use an old Martello tower for this purpose.
10	None	None	No isolation hospital. No disinfecting apparatus. No mortuary. The S.A. are, however, negotiating for a site for an isolation hospital.	—	Dr. Fletcher	S.A. urged by Dr. Fletcher to provide isolation accommodation immediately. In a special Report, dated Nov. 8th, 1892, on the water supply of Clacton-on-Sea, the M.O.H. indicates his suspicion as to the liability to contamination of two of the four wells from which the Gas and Water Company supply the town.

SOUTH COAST.

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION.

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
1	MARGATE U.S.D.	Ramsgate	Calais, Boulogne, and Cherbourg. The Calais and Boulogne traffic consists of pleasure day trips between those places and Margate.	—	None	About 60	About 240	Urban M.O.H. at salary of 130*l.* per annum.	Urban I. of N. at salary of 130*l.* per annum. Receives occasional assistance.
2	BROADSTAIRS U.S.D.	Ramsgate	None	"Mostly coal barges."	—	—	32	Urban M.O.H.	Urban I. of N., who is also surveyor to the U.S.A., and in private practice as a surveyor.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug 28th, 1890.				
1	At entrance to harbour unless sickness is signalled, in which case vessels are boarded outside the harbour entrance.	Mooring station fixed about 1¼ miles N.E. of Margate Lighthouse, and within S.A.'s jurisdiction. Good anchorage, but in gales between N.W. and S.E., vessels might have to run to the Downs or to Whitstable.	S.A. send cases of infectious disease, other than cholera, to the Isle of Thanet Joint Hospital at Northwood, 2¼ miles distant from Margate. For cholera cases they have provided an old three-roomed cottage in a yard, belonging to the Corporation in Victoria Road. This cottage has dilapidated wooden floors, and is unprovided with any administrative accommodation. Excreta would be put down the yard gully. A horse ambulance and hot-air disinfecting chamber are kept in the same yard. No public mortuary. One at the cemetery and one at the Cottage Hospital (for accidents).	No	Dr. T. Thomson -	S.A. urged by Dr. Thomson to provide better and more extensive isolation accommodation for cholera cases; also to provide a steam disinfecting apparatus. Small coasters and French fishing boats occasionally hold communication with the shore at Newgate Gapway, which is in the Margate U.S.D. There is a coastguard station near Newgate Gapway.
2	Apparently none -	None - - -	No hospital provision for cholera cases. No ambulance, and no disinfecting apparatus. On payment S.A. would be allowed to use Isle of Thanet disinfecting apparatus. They also have right of sending cases, other than those of cholera, to the Isle of Thanet Joint Hospital. The S.A. possess a public mortuary.	—	Dr. T. Thomson -	The Isle of Thanet Joint Hospital Board have refused to deal with cholera cases. For the ordinary infectious diseases their hospital serves the Ramsgate, Margate, and Broadstairs Urban, and the Isle of Thanet Rural Districts, but the accommodation afforded is insufficient for the districts in question. In addition to Broadstairs Harbour there are three or four places along the Broadstairs Urban coast at which vessels might, and occasionally do, hold communication with the shore.

SOUTH COAST—*continued.*

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
3	RAMSGATE U.S.D.	Ramsgate	Boulogne and Calais (day trippers); Ostend; Norway and Sweden.	—	None	441	911	Urban M.O.H., at salary of 150*l.* per annum.	Urban I. of N., at salary of 150*l.* per annum. Temporary I. of N. also appointed during present emergency at salary of 30*s.* a week.
4	DOVER U.S.D.	Dover	Principally with Calais and Ostend. Also Baltic and Black Sea ports (timber and grain).	"Mostly coal"	None	3,055	837	Urban M.O.H., at salary of 240*l.* per annum. Also acts for several other districts (East Kent combined). There is also an Asst. M.O.H.	Urban I. of N., at salary of 150*l.* per annum. There is also an Asst. I. of N.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28th, 1890.				
3	Just inside the entrance to the outer harbour.	Mooring station fixed in Ramsgate Roads ¼ mile N.N.E. of the west pier head.	For the isolation of cholera cases, U.S.A. have rented two semi-detached villas about two-thirds of a mile from harbour. These houses are situated on a triangular piece of land, and there is room for extension. Accommodation at present for 16 cases and nurses. Ramsgate water laid on. Drainage into cesspool. U.S.A. possess a horse ambulance and a hot-air disinfecting apparatus. No arrangements made for conveyance of patients from vessels to the shore. The approach to the "Cholera Hospital" above described is by private roads which might be closed at any time. There is a public mortuary, and also one at the cemetery and at the Seaman's Hospital.	Occasional inspection made, but no record kept.	Dr. T. Thomson -	Having regard to the danger of polluting the Ramsgate water supply, part of which is obtained from wells, U.S.A. were advised by Dr. Thomson to connect the proposed "Cholera Hospital" with the town sewers, and abolish the existing cesspool. They were also advised to procure a steam disinfecting apparatus, and to make suitable water ambulance arrangements. Except at the town and harbour of Ramsgate, there is no place in this U.S.D. at which it is considered likely vessels would attempt to make a landing. The portion north of the town is rocky; and communication with the Pegwell Bay side is unlikely on account of the flats.
4	Calais and Ostend boats boarded at Admiralty Pier. Other vessels boarded just outside harbour entrance.	Mooring station fixed in Doon Bay with approval of Customs officer. It is half a mile from shore, and east and west of Admiralty pier, according to wind.	U.S.A. possess an infectious hospital for 24 patients, about, but it is on a hill a mile and a half from the harbour. There is a laundry; a Washington Lyon disinfector; a horse ambulance; and a mortuary at hospital. Also a mortuary abutting on the seaboard.	—	Dr. T. Thomson -	Dr. Thomson pointed out the inaccessibility of hospital for cholera purposes and advised a hospital in a more convenient situation. Also advised provision of some means of transport of U.S.A.'s officers and cholera patients by water. Mooring station, perhaps, the best to be had, but in certain weathers vessels would have to run for shelter. Subsequent to Dr. Thomson's visit U.S.A., on advice of Asst. M.O.H., promised a site for a cholera camp, and made arrangements for nursing, &c.

SOUTH COAST—*continued.*

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
5	FOLKESTONE U.S.D.	Dover and Folkestone.	Boulogne chiefly. Also the Channel Islands, the Baltic, and North Russian ports.	Chiefly coal and timber.	None	942	159	Urban M.O.H., at salary of 150*l.* per annum.	Urban I. of N., at salary of 150*l.* per annum. Also acts as Inspector of Buildings, at salary of 50*l.* per annum.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, Aug. 28th, 1890.				
5	Just outside the harbour.	Within the waters of the U.S.D., and approved by Customs officer.	For cholera purposes U.S.A. proposed to use their small-pox hospital. This is a corrugated iron structure containing two wards, ante-room, kitchen, scullery, and one bedroom. Wash-house and storeroom in outbuildings. Hospital 1¼ miles from harbour and difficult of access. Earth closets for excreta. Slop drainage loses itself in the ground. Water supply, rain-water stored in brick and mortar underground tank. This hospital would accommodate four patients or, possibly, six. U.S.A. also possess a "fever hospital" for some 16 patients. This is a good brick building, ¼ mile from the harbour. It was over-full at time of inspection. It drains into the town sewers. Fraser's hot-air disinfecting apparatus at "fever" hospital. Also two horse ambulances, one to be kept for cholera cases. No water ambulance. No public mortuary, but one each at fever hospital, general hospital, and cemetery.	No	Dr. T. Thomson -	Dr. Thomson pointed out to U.S.A. the need for more suitable isolation accommodation, a steam disinfecting apparatus, and some provision for the transport of patients and conveyance of S.A.'s officers by water. Subsequently Dr. Thomson paid a second visit to Folkestone with special reference to the possibility of communication between vessels coming from foreign and the shore at points in U.S.A.'s jurisdiction other than the harbour. Such communication Dr. Thomson found might occur (especially on the Sandgate side where vessels are often detained by weather in Sandgate Bay), and he urged special vigilance with respect to the matter. At this visit Dr. Thomson learnt that the S.A. were looking for a site for a cholera hospital. No arrangements had been made as regards a water ambulance beyond the authorising by S.A. of M.O.H. to hire an off-shore boat when required. In a special report on cholera precautions, dated November 15th, 1892, the M.O.H. states that "means of transport both by land and sea for "patients suffering from cholera on any vessel "have been provided." It also appears from this report that a site for a new cholera hospital has been acquired "near the cement works," but that no building had at the date of report been erected upon it.

SOUTH COAST—*continued.*

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Heath.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
6	BRIDPORT U.S.D.	Weymouth	Norway (timber); Russia (flax and hemp).	North ports (coal).	None	3	52	Urban M.O.H., at salary of 40*l.* per annum. M.O.H. acts also as D.M.O. Appointed annually.	Urban I. of N., at salary of 40*l.* per annum. I. of N. acts also as Surveyor to U.S.A. Appointed annually.
7	LYME REGIS U.S.D.	Exeter	Occasional though rare trade with the Channel Islands. Formerly a few vessels with corn came from France, but none the last few years.	Chiefly coal trade with the Humber, Tyne, and Scotch ports.	None	None	140	Urban M.O.H., at salary of 10*l.* per annum.	Urban I. of N., at salary of 20*l.* per annum. I. of N. also acts as Urban Surveyor.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
6	Boarding mostly done alongside the quay.	Mooring station not fixed at time of inspection.	U.S.A. possess a wooden hospital on shore near harbour. It was erected for cholera in 1866. It is ready for immediate use and would serve for cholera emergency. Water could be laid on. Drainage into sand soil. Disinfection by sulphur fumigation. Mortuary at cemetery, two miles from harbour.	Not systematically.	Dr. Downes -	U.S.A. urged to fix mooring station. They have since fixed, with approval of Customs officer, "the gangway opposite the sluices inside "the harbour at West Bay."
7	In the harbour. There are difficulties in regard to boarding outside, but Chief Officer will give orders for this to be done as far as possible.	No mooring station fixed.	No isolation hospital. No disinfecting apparatus. No mortuary. A two-storied warehouse is, however, being got ready for use as a temporary cholera hospital. It contains a small room and a ward 14 feet by 25 feet on the upper floor.	No	Dr. Downes -	U.S.A. advised by Dr. Downes to fix upon a mooring station. A spot under North wall was suggested, and would apparently be approved by the Customs officer. Also advised as to fitting up hospital, &c. According to a short report submitted to the U.S.A. by the M.O.H. subsequently to Dr. Downes' visit, and forwarded by the Clerk to the Board on November 4th, it would seem that Dr. Downes' advice was being followed.

WEST COAST.

Urban Riparian Districts inspected during 1892; with certain specified Particulars of Shipping Trade and Sanitary Administration.

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
1	ILFRACOMBE U.S.D	Barnstaple	A vessel laden with timber expected from Hamburg at time of inspection.	—	—	—	—	Urban M.O.H., at salary of 50*l.* per annum.	Urban I. of N.
2	LYNTON U.S.D.	Barnstaple	—	Steamers from Ilfracombe and small fishing boats.	—	—	—	Urban M.O.H., at salary of 20*l.* per annum.	Urban I. of N., who is also Surveyor to U.S.D.
3	BARRY AND CADOXTON U.S.D.	Cardiff	Baltic, German, French, Dutch, Spanish, and American ports. (About 10 vessels a month each from Hamburg and Antwerp. A larger number from French ports, notably Havre.) Trade chiefly export of coal, vessels returning light. A few, however, from the Baltic, bring timber.	Considerable coasting trade.	None	858	1,036	Urban M.O.H., at salary of 75*l.* per annum. No extra remuneration for port work.	Urban I. of N., at salary of 105*l.* per annum. An Asst. I. of N. was also appointed in 1891 mainly for port work.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
1	—	—	Small isolation hospital, containing four beds, in the town. Disinfecting chamber at hospital.	—	Dr. Copeman	In view of possible importation of cholera extra precautions have been taken with regard to inspection of markets, dwellings, &c. Disinfectants and printed suggestions as to treatment of cholera distributed. The town has an abundant and pure water supply, and is well drained.
2	—	—	No hospital accommodation	—	Dr. Copeman	No special precautions taken with regard to cholera. Drainage and water supply both fairly good. The chief of the coastguard acts for the Customs.
3	The usual boarding station is the dock basin. U.S.A. have, however, temporarily hired a steamer for the conveyance of their officers, and it is proposed that the Customs officer should also have passage in this steamer and board vessels in the Roads. The matter was not, however, definitely settled at time of inspection.	Mooring station fixed, with approval of Customs officer, between Sully Island and Bendrick Rock.	For the purpose of isolating cholera patients U.S.A. have arranged by agreement with Cardiff P.S.A. to erect a marquee on Flatholm Island from Sept. 14th to Dec. 25th, 1892. It is to provide accommodation for six patients. U.S.A. also possess a wooden hospital near the docks, and have recently purchased land for the erection of a permanent isolation hospital. The existing wooden hospital is kept in readiness, but it is not proposed to use it for cholera if it can be avoided. It is drained into the Dock Company's sewer, and supplied with water from the Dock Company's mains. U.S.A. possess a mortuary at their depôt, and also a hot-air disinfecting apparatus.	Yes	Mr. T. W. Thompson.	Sanitary authority active. Arrangements generally satisfactory as far as circumstances permit.

WEST COAST—*continued.*

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
4	LLANELLY U.S.D.	Llanelly	Norway, Sweden, Dieppe, Rouen, Havre, Landernau, St. Malo. Occasionally also Antwerp and Rotterdam. No direct trade with Hamburg, but Hamburg vessels sometimes come on (in ballast) from other English ports. A few vessels from America and Nova Scotia. Trade chiefly copper ore and timber.	—	None	154	597	Urban M.O.H.	Urban I. of N.
5	KIDWELLY U.S.D.	Llanelly	None	Little coasting trade.	—	—	—	Urban M.O.H., who resides at Kidwelly.	Urban I. of N.
6	CARMARTHEN U.S.D.	Llanelly	Timber from the Baltic and Canada.	Occasional steamers from Bristol and Liverpool. Also slates from Carnarvon, bricks from Bridgwater. Irish paving stones. No collier traffic. Onion men from Roshoff (in Finisterre) come to Swansea, and thence by rail to Carmarthen.	None	3	106	Urban M.O.H., at salary of 80*l.* per annum.	Urban I. of N., at salary of 65*l.* per annum.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
4	Usually near the harbour light, but whenever possible infected vessels will be boarded at No. 7 Buoy, about two miles down the river.	At No. 7 Buoy - -	Ducker hut erected on sandy site near rifle range, about 1½ miles from centre of town. Contains two wards for four patients each, with a nurse's room and closet (commode) between them. Room for extension. Water would be carried from town pipe 200 or 300 yards distant. Excrement to be disinfected and buried. Patients would usually be landed just inside harbour and carried overland for ¼ mile. No mortuary.	Occasionally, but no record kept.	Dr. Downes -	U.S.A. about to order a portable Washington Lyon's disinfecting apparatus. They were urged by Dr. Downes to appoint a qualified Deputy M.O.H., to ensure the inspection of vessels with the least possible delay. Also to arrange for the use of a steam launch for the conveyance of their officers and the officers of Customs. The launch belonging to the Harbour Commissioners will probably be available for this purpose. The importance of inspecting vessels under the Public Health Acts was also pointed out. The Harbour Commissioners have directed pilots to bring up all vessels from foreign at No. 7 Buoy for boarding by the Customs officials. Question as to desirability of constituting a Port Sanitary Authority for the River Bury.
5	—	—	None - - - - -	—	Dr. Downes -	This district was not visited, but Dr. Downes conferred with the Clerk to the U.S.A., who resides at Llanelly, and also with the Chief Officer of Customs.
6	No Customs officer now stationed at Carmarthen. One comes over from Llanelly occasionally.	None fixed upon -	So-called infectious diseases hospital, attached to the police station in the centre of the town. It is part of the old borough gaol. Apparently never yet used by U.S.A. for hospital purposes. Contains one room for four patients and a room for attendant; one or two odd rooms for stores, &c. Town water laid on to yard. Drainage into town sewers. No ambulance. Fair mortuary at this "hospital," and arrangement for sulphur fumigation. No means of cooking or washing.	No	Dr. Downes -	U.S.A. apparently only have jurisdiction over the west bank of the river, the east bank being under jurisdiction of Carmarthen R.S.A. Vessels discharge sometimes in the urban and sometimes in the rural district. U.S.A. advised to fix mooring station. "Blackpool" in the river just below the borough boundary was suggested as the best place for both urban and rural districts. U.S.A. also advised to provide accommodation for isolation, an ambulance, and means of disinfection in conjunction with R.S.A. The existing "hospital" Dr. Downes considers unsuitable, on the ground of position, for cholera cases.

WEST COAST—*continued.*

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
7	TENBY U.S.D.	Milford	About two vessels a year from Norway with ice. Vessels of all sorts lie under Caldy Island for stress of weather, and may communicate with Tenby.	A passenger steamer from Bristol every week all the year round. She also carries cattle and general cargo, going on to Pembroke Dock and Wexford, and sometimes calling on her return journey. Coasting trade also with Bideford and Clovelly (limestone), and Caldy (vegetables).	None	1	80	Urban M.O.H.	Urban I. of N.
8	YNYSCYNHAIARN U.S.D. (PORTMADOC).	Carnarvon	The Baltic, Dunkirk, Harburg, Altona, Copenhagen, Stettin, Gothenburg, Friedrichstadt, Darien (Georgia), and North America. Occasionally one in ballast from Lisbon and Havre. Vessels also shelter in the Roads, their crews coming on shore.	Dublin, Liverpool, and Bristol Channel.	None	About 60. All sailing vessels.	About 1,000.	M.O.H. to Carnarvonshire combined districts, who resides at Carnarvon. As there might be difficulty in getting M.O.H. from Carnarvon to Portmadoc in 12 hours, U.S.A. have temporarily appointed all the four medical men living at Portmadoc as Deputy M.O.s.H. for the purpose of carrying out the Cholera Order.	Urban I. of N., who also acts as surveyor. Resides at Portmadoc.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
7	No Customs House at Tenby. Customs duties performed by coastguard. Vessels boarded either in Tenby or Caldy Roads.	Caldy Roads fixed as a mooring station in 1890, but not submitted to Customs officer for approval. Probably unsafe in heavy S.E. gale.	Owing to outbreak of small-pox at Pembroke Dock, Tenby U.S.A. hired a cottage until September 1892, for isolation purposes. Contains kitchen, sitting-room, and two small badly-lighted and badly-ventilated bedrooms and out-houses. No drainage. Water has to be carried. No ambulance. No disinfecting apparatus. Mortuary being built for the town.	No	Dr. Downes - -	U.S.A. advised by Dr. Downes to provide a proper isolation hospital and disinfecting apparatus. But in order to provide accommodation for isolation in the meantime, they were advised to prolong, for a while, their tenancy of the cottage at present secured for isolation purposes, and to provide that cottage with water-supply, means of cooking, washing, &c., and to arrange for nursing. Letter addressed by the Board to U.S.A. on September 20th, 1892, urging need for adequate isolation accommodation, and asking to be informed as to result of U.S.A.'s consideration of Dr. Downes' recommendations in this behalf.
8	At Pwllglanymor, inside the bar. About 1½ to 2 miles below Portmadoc.	Mooring station fixed at Pwllglanymor.	An isolated two-roomed cottage on site about ¼ acre in extent at Glanydon, about one mile from place where patients from ships would be landed. Patients to be brought to shore in ships' boats, and carried to hospital on improvised stretcher. Cottage contains one small room for nurse, and one ward 18′ × 15′. Also out-house. Furniture to be provided when required. Copper to be put in out-house. Water from spring 50 yards away, and between cottage and sea. Soil, sand. Excreta to be buried. No arrangements made for nursing. No disinfecting apparatus. No mortuary at cottage, but one at Portmadoc.	No	Dr. Downes - -	U.S.A. advised by Dr. Downes to have their hospital in readiness for immediate use, all arrangements as to nursing, &c., being made beforehand. Need for great care as to disposal of excrement, &c., at the hospital pointed out, more especially having regard to the source of the water-supply. Customs officer advised to challenge crews coming from vessels sheltering in the Roads. Pilots ordered by Pilotage Sub-Commissioner to bring up vessels coming from foreign in St. Judnal's Roads until inspected by M.O.H.

WEST COAST—*continued.*

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
9	HOLYHEAD U.S.D.	Beaumaris	Large numbers of wind-bound vessels put into the harbour. Apparently little foreign trade.	Ireland (chiefly passenger traffic). Very little else.	None	17	2,468	Urban M.O.H., at salary of 18*l.* per annum. M.O.H. resides at Llanerchymedd 15 miles away.	Urban I. of N., who is also Surveyor and Collector.
10	LLANDUDNO U.S.D.	Beaumaris	Apparently none	Passenger steamers from Liverpool, &c. A fishing-boat occasionally puts in.	—	—	—	M.O.H. to Carnarvonshire combined districts.	Urban I. of N., who gives his whole time to the duties.
11	BLACKPOOL U.S.D.	Fleetwood and Preston.	None	No commerce. The only shipping consists of pleasure steamers during the summer to Glasson Dock, Morecambe, Douglas, Barrow, Liverpool, Southport, Llandudno, Beaumaris, Menai Straits, Preston, Lytham, and Fleetwood.	None	—	—	Urban M.O.H., at salary of 30*l.* per annum. Appointed annually.	Urban I. of N., at salary of 13*l.* per annum. Appointed annually.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
9	Within a line drawn from the end of the breakwater to the end of the pier.	No mooring station fixed at time of inspection.	U.S.A. could send cases to the isolation ward of a small general hospital on "Salt Island." This would accommodate two patients. It is detached, and there is room for extension. Drainage into harbour. An old brougham in a state of dry rot kept for ambulance. Small mortuary at hospital. No disinfecting apparatus.	Apparently not.	Dr. Copeman	At the time of inspection Clerk was under the impression that Holyhead was still a Port Sanitary District as it was formerly. U.S.A. advised by Dr. Copeman to appoint a mooring station, and accordingly a spot, near the end of the breakwater, in the outer harbour, was selected, with the approval of the Queen's Harbour Master. U.S.A. also advised to procure an efficient disinfecting apparatus. The U.S.A. have not appointed any local medical man to act as Deputy to the M.O.H. in cases of urgency, and until the latter could arrive. M.O.H. seems, however, to have made some such arrangement on his own account.
10	—	—	Isolation hospital for 28 patients. About a mile outside the town. Ransome's hot-air disinfecting chamber. Small mortuary at hospital; larger one at Town's yard.	—	Dr. Copeman.	—
11	No Customs officer at Blackpool.	None fixed	For infectious diseases generally, U.S.A. possess a new sanatorium, which will accommodate, in all, 20 patients, in six separate wards. For cholera they would use their old "sanatorium," a wooden building, with accommodation for four patients, and room for extension. It is situated about a mile to the east of the centre of the borough, mortuary on the premises. Washington Lyon's steam disinfector, and also an ambulance at new sanatorium.	No	Mr. T. W. Thompson.	At a conference with the Clerk and M.O.H. it was pointed out that in the event of England becoming invaded with cholera in 1893, the pleasure steamers would, if they continued to run, require careful watching. No other riparian functions in this district.

WEST COAST—*continued.*

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
12	ULVERSTON U.S.D.	Barrow	None	Some coasting trade.	None	—	About 15 each month.	Urban M.O.H., at salary of 52*l.* 10*s.* per annum. M.O.H. acts in similar capacity for Grange Urban and Ulverston Rural Districts.	Urban I. of N., at salary of 90*l.* per annum.
13	BARROW-IN-FURNESS U.S.D.	Barrow	The Baltic, Black Sea, Mediterranean, and American ports. A few vessels from India, Belgium, Holland, and France, and occasional ones from Hamburg and Antwerp. Trade consists of timber, iron ore, grain, and general merchandise. No emigrant or foreign passenger traffic.	Considerable coasting traffic.	None	95	1,532	Urban M.O.H. Appointed annually at salary of 100*l.*	Urban I. of N., at salary of 150*l.* Also Second Urban I. of N., at salary of 30*s.* per week.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
12	No Customs officers at Ulverston.	None fixed upon	No isolation accommodation. No disinfecting apparatus. No mortuary available for cholera purposes.	Vessels said to be inspected.	Mr. T. W. Thompson.	U.S.A. urged to provide isolation accommodation. In reply to letter from the Board on this matter (November 2nd, 1892), S.A. replied on December 13th, that "they had made provision for hospital "accommodation."
13	In the basin at entrance to Ramsden Dock.	Near Piel Island	U.S.A. have had plans prepared for a wooden hospital of two wards, containing eight beds each, to be erected on Sheep Island. A portion of this hospital, to accommodate four patients, said to be in process of erection; the remainder to be added if required. Plans show also administrative block, laundry, mortuary, and disinfecting block. Water supply from well. Excrement to be buried. U.S.A. also possess an isolation hospital for 26 patients, a dry heat disinfecting apparatus, and a mortuary at the Town's yard.	Yes; but no record kept.	Mr. T. W. Thompson.	U.S.A. have arranged for the hire of a steam tug for the use of their officers when required. The Customs boarding station was formerly at Roe Island near the entrance to the river. This was far better for health purposes than the present arrangement, which is very unsatisfactory. To overcome the difficulty for the time being, the U.S.A. have issued a leaflet, which the Pilotage Board have instructed pilots to deliver, warning masters of ships that any vessel entering the dock with cholera on board will be immediately put out, even at danger of grounding, and advising them, therefore, if their vessels are infected, to anchor outside. U.S.A. advised at conference not to limit their action, as regards isolation accommodation, to the erection of one ward for four patients, and nurses' room; but to erect, in first instance, two wards for four patients each, with mortuary, laundry, &c.

WEST COAST—*continued.*

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
14	MILLOM U.S.D.	Whitehaven	Spain (Bilbao) and Norway. Trade—iron ore and timber.	Fair coasting trade.	None	11	740	Urban M.O.H., at salary of 150*l.* per annum. Deputy M.O.H. appointed temporarily for cholera purposes at fee of 1*l.* 1*s.* a visit.	Urban I. of N., at salary of 95*l.* per annum. Additional temporary I. of N. appointed for cholera purposes. Period of appointment and salary not fixed at time of inspection.
15	WHITEHAVEN U.S.D.	Whitehaven	None. The Harbour and Docks being at present in the R.S.D.	None	None	—	—	Urban M.O.H., at salary of 75*l.* per annum. M.O.H. also acts for R.S.D.	Urban I. of N. at salary of 100*l.* per annum.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
14	No resident Customs officer at Millom. It is visited occasionally from Whitehaven.	Mooring station fixed between Hodbarrow Pier and the iron-works. Dry at low water; but vessels coming to Millom constructed to take the ground. Mooring station not referred to Customs officer for approval.	U.S.A. have erected a wooden cholera hospital in isolated position near harbour. One ward for three patients, and two rooms for nurses. Town water. Drainage into tidal creek. Detached earth closet. The hospital was quite ready to receive patients. Ample room for extension, and S.A. possess two similar huts, which would be erected if required. No disinfecting apparatus. No mortuary.	Not hitherto.	Mr. T. W. Thompson.	U.S.A. advised to provide mortuary in connexion with cholera hospital: Also, to make regulations under section 125 of the Public Health Act, and to arrange for systematic inspection of vessels under the Public Health Act. Clerk informed as to need for obtaining consent of Customs officer to mooring station.
15	—	—	U.S.A. possess only a very unsatisfactory hospital, but they are about to provide a better one. Site well isolated at top of hill, three-quarters of a mile from centre of town. No disinfecting apparatus. Wooden mortuary at hospital.	—	Mr. T. W. Thompson.	Boundaries of district very unsatisfactory, since they just exclude the harbour and docks, which are therefore in Whitehaven R.S.D.

WEST COAST—*continued.*

URBAN RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
16	MARYPORT U.S.D.	Maryport	Baltic, German, French, and Spanish ports. Imports—chiefly iron ore.	Considerable coasting trade.	None	63	1,180	Urban M.O.H., at salary of 40*l.* Appointed annually.	Urban I. of N., at salary of 60*l.* Appointed annually.
17	HOLME CULTRAM U.S.D. [Silloth.]	Carlisle	Baltic, German, Dutch, and American ports. Occasionally a vessel from Spain.	Fair coasting trade.	None	16	605	Urban M.O.H., at salary of 20*l.* per annum. Appointed annually.	Urban I. of N., at salary of 30*l.* per annum. Appointed annually.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
16	At the pier head in ordinary times. During danger of cholera, vessels from infected ports will, as far as possible, be boarded in the roads.	Owing to exposed character of the coast, it was proposed to send infected vessels to Silloth Roads, or to moor them in Senhouse Dock. (*See* Remarks.)	U.S.A. have no proper isolation hospital, but one is in contemplation. In the meantime they would put cholera patients in some disused offices near the dock. These offices have no drainage, but the town water is laid on. They were not furnished at time of inspection. A mortuary had, however, been provided near them. No disinfecting apparatus.	Yes	Mr. T. W. Thompson.	At the conference it was pointed out to the officers of the S.A. that they had no power to systematically send infected vessels to Silloth Roads, which is in another Customs port; and that it was not desirable to moor such vessels in the Senhouse Dock, if it could possibly be avoided. The matter having since been reconsidered, it has been agreed that the anchorage off Maryport is quite safe in ordinary weather, and this has therefore been selected as the mooring station, with the approval of the Collector of Customs. Vessels to run elsewhere for shelter, if necessary, in bad weather, provided they signal their intention of doing so. The importance of having some suitable accommodation for isolation in actual readiness before next summer was insisted upon.
17	At the pier head in ordinary times, but during danger of cholera vessels would be boarded in the roads when possible.	In Silloth Roads, about one mile south of Silloth Dock.	No means of isolation in readiness. S.A. possess a small wooden hut (one room), which they propose to erect if required. No disinfecting apparatus. No mortuary.	No	Mr. T. W. Thompson.	S.A. advised not to rely upon their imagined ability to erect a hospital when required, but to have such hospital actually in readiness for the reception of patients at short notice: Also informed as to their duty with respect to the inspection of shipping under the Public Health Act. It was agreed that a hospital should be provided, and that shipping should be inspected in future. In a letter to the Board, dated December 20th, 1892, the M.O.H. states that the S.A. have arranged to place a wooden hut on Silloth Banks, opposite Silloth Bay.

EAST AND WEST COASTS.

RURAL RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION.

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891. From Foreign.	Vessels Inwards in 1891. Coastwise.	Medical Officer of Health.	Inspector of Nuisances.
1	BELFORD R.S.D. (NORTH SUNDERLAND).	Berwick	Baltic to small extent	Fishing	None	—	36	Rural M.O.H., at salary of 50*l.* per annum.	Rural I. of N.
2	WOODBRIDGE R.S.D.	Ipswich	—	Very few vessels of any sort, except one or two small private yachts.	—	—	—	Rural M.O.H., at salary of 50*l.* per annum.	Rural I. of N.
3	CAMELFORD R.S.D. (BOSCASTLE).	Padstow	None	Coal from South Wales and Liverpool. Artificial manure from Plymouth, Swansea, and Bristol.	—	—	—	Rural M.O.H., who lives at Boscastle.	Rural I. of N., who lives at Camelford.

No.	Arrangements concerniug Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
1	Vessels boarded in the harbour. No officer of Customs resident at North Sunderland.	—	No hospital or disinfecting apparatus, mortuary, or ambulance.	No	Dr. Barry - -	At the conference the R.S.A. undertook to provide isolation accommodation, and to make arrangements for the examination of all vessels entering the port of North Sunderland from foreign. The pilots would inform the parochial committee of North Sunderland of the arrival of any such vessels. A letter dated Sept. 17th, 1892, from this R.S.A. to the Board, states that a cottage near "Sea Houses," North Sunderland, has been hired by the R.S.A., and fitted up for the purposes of isolation.
2	Vessels coming to Woodbridge are boarded by the Customs officer at Harwich.	No mooring station fixed.	The only isolation accommodation possessed by the R.S.A. is a small cottage hospital, access to which is through the town. It is not suitable for cholera cases.	—	Dr. Copeman -	R.S.A. advised by Dr. Copeman to hire, for isolation purposes, a small empty cottage which stands by itself on the bank of the river, some distance from the town. As the members of the R.S.A. mostly live some distance from the town, they were advised to appoint a sub-committee, to act as occasion requires. M.O.H. undertook to inspect any vessels from foreign should such arrive at Woodbridge.
3	No Customs officer at Boscastle. Coast-guard would notify arrival of any suspected vessel to M.O.H.	Difficulty in fixing mooring station. Anchorage outside harbour dangerous; inside vessels would take the ground at low water: A vessel might thus have to run to Padstow.	No hospital or disinfecting apparatus in the district. An isolated cottage would be made use of for isolation if necessary.	Yes, by M.O.H.	Dr. Bulstrode -	Boscastle is the only place in this district at which vessels from foreign are likely to arrive. The harbour is quite a small one, and at low water vessels in it are left high and dry. The entrance is extremely dangerous. Infectious Disease (Notification) Act in force.

WEST COAST—*continued.*

RURAL RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
4	BIDEFORD R.S.D. (CLOVELLY).	Barnstaple	Apparently none	Occasional boats from Cardiff, Swansea, and Bristol. In the summer passenger steamers from Bristol and Ilfracombe.	—	—	No record kept. About two or three each month.	Rural M.O.H., who is also M.O.H. to Barnstaple P.S.D.	Rural I. of N.
5	BRIDGEND AND COWBRIDGE R.S.D. (part).	Cardiff	None	Occasional boats from Cardiff, Newport, and Devon coast. A few fishing-boats.	None	—	—	Rural M.O.H., who also acts for Cowbridge Borough, and resides at Cowbridge.	Rural I. of N., who resides at Bridgend.
6	CARDIFF R.S.D.	Cardiff	None	Same as above (Bridgend).	None	—	—	Rural M.O.H., who resides at Cardiff.	Rural I. of N., who resides at Cardiff.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts ?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
4	No Customs officer at Clovelly. The nearest is at Appledon. The Coastguard would board any vessels from foreign, and wire to the M.O.H. if necessary.	—	No hospital accommodation nearer than Bideford.	—	Dr. Copeman	The harbour is almost dry at low water. No special precautions taken other than those described in the foregoing columns.
5	—	—	No isolation accommodation or disinfecting apparatus.	No	Mr. T. W. Thompson.	This inspection extended only to that part of the Brigend and Cowbridge district which is in the Cardiff Customs port. The only landing place in this portion of the district is at the East Aberthaw River, one bank of which is in the Bridgend and Cowbridge R.S.D., and the other bank in the Cardiff R.S.D. M.O.H. advised to point out to his S.A. the desirability of temporarily appointing an Assistant I. of N. at East Aberthaw, to watch the shipping procedures there. Also advised attention to sanitary improvements generally, and provision of hospital accommodation.
6	—	None fixed	No isolation accommodation or disinfecting apparatus.	No	Mr. T. W. Thompson.	Only landing place in this R.S.D. said to be the East Aberthaw River [*see* Bridgend R.S.D. above]. Same advice given to Cardiff R.S.A. as to M.O.H. of Bridgend and Cowbridge. A temporary I. of N. at East Aberthaw has, I understand, been appointed.

WEST COAST—*continued.*

Rural Riparian Districts inspected during 1892; with certain specified Particulars of Shipping Trade and Sanitary Administration—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
7	GOWER R.S.D.	Swansea and Llanelly.	None	Only an occasional boat from the Devon coast to Port Eynon for stone.	—	—	—	Rural M.O.H., who lives at Reynoldstone.	Rural I. of N.
8	LLANELLY R.S.D.	Llanelly	France chiefly. A little with Nova Scotia, also Antwerp, and occasionally Norway.	—	None	32	300	Rural M.O.H.	Two I.'s of N., who devote their whole time to the work.
9	CARMARTHEN R.S.D.	Llanelly	—	—	—	—	—	M.O.H. to Carmarthen combined sanitary districts, resides at Carmarthen.	Two Rural I.'s of N., residing at Carmarthen and St. Clears respectively.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under the Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
7	—	—	—	—	Dr. Downes	This district was not actually inspected. The information given by Dr. Downes was obtained from the Assistant Clerk, and it was not thought necessary to proceed further with the inspection at the time.
8	Same as for Llanelly urban, viz., No. 7 Buoy.	No. 7 Buoy would probably be used, but has not apparently been fixed upon.	An unfinished iron hut on sandy site at Pembrey, near boarding station. Would accommodate about two patients in the one ward. There is also small nurses' room and kitchen. No disinfecting apparatus or mortuary. Ample room for extension. Water has to be carried about 500 yards. Excrement and slops to be disinfected and buried. Patients from ships could be landed direct in fine weather.	No	Dr. Downes	The only shipping in this district is at Pembrey or Burry Port [*see* Llanelly urban]. R.S.A. advised by Dr. Downes to make arrangements as to nursing, furniture, &c., for the hospital, in order that it might be in readiness beforehand. Also advised to arrange with U.S.A. and Harbour Commissioners for joint use of the launch belonging to the latter.
9	No Customs officer	No mooring station fixed.	No provision for isolation, &c.	—	Dr. Downes	*See* Carmarthen U.S.D. Water supplies in this district apparently unsatisfactory. Enteric fever recently.

WEST COAST—*continued.*

RURAL RIPARIAN DISTRICTS INSPECTED during 1892; with certain specified PARTICULARS of SHIPPING TRADE and SANITARY ADMINISTRATION—*continued.*

No.	Sanitary District.	Customs Port in which the Sanitary District is situated.	Principal Foreign Trade with—	Principal Coasting Trade with—	Inland Water Communication.	Vessels Inwards in 1891.		Medical Officer of Health.	Inspector of Nuisances.
						From Foreign.	Coastwise.		
10	NARBERTH R.S.D. (SAUNDERS FOOT).	Llanelly and Milford.	French ports, chiefly Dieppe. An occasional vessel from Hamburg.	Special trade in anthracite coal.	—	About six yearly.	About 200 yearly.	Rural M.O.H., who resides at Saunders Foot. Is M.O.H. for a portion only of Narberth R.S.D.	Rural I. of N., who resides at Narberth.
11	ANGLESEY R.S.D. (AMLWCH).	Beaumaris	——	—	—	6	179	Rural M.O.H., who lives at Llanerchymedd, 15 miles from Amlwch.	Rural I. of N., who also lives at Llanerchymedd.
12	WHITEHAVEN R.S.D.	Whitehaven	The Baltic, Antwerp, Sweden, and North America. Trade mostly timber.	—	None	37	2,03	Rural M.O.H., who also acts for U.S.D.	Rural I. of N., who resides five miles from the Docks.

No.	Arrangements concerning Customs Authorities.		Hospital Provision for Cholera Cases, Means of Disinfection, Conveyance of Patients to Hospital, &c.	Are Vessels inspected under Public Health Acts?	Inquiry by—	Remarks.
	Customs Boarding Station.	Mooring Station under Art. 6, Cholera Regulations, August 28th, 1890.				
10	No Customs or Coast-guard officer at Saunders Foot.	None fixed - -	No accommodation for isolation, but R.S.A. are said to be negotiating for a cottage at Saunders Foot for the purpose.	—	Dr. Downes -	Harbour Master at Saunders Foot advised by Dr. Downes to let the M.O.H. there know of the arrival of any vessel from foreign. In letter dated Dec. 8th, 1892, it is stated, in reply to a communication from the Board, *re* isolation accommodation and other matters, that the R.S.A. have received the permission of a land-owner to erect an isolation hospital upon his land.
11	Customs officer would board any vessel coming from foreign into the bay, and wire to M.O.H. if necessary.	It is proposed to send infected vessels either to the Bangor and Beaumaris P.S.D. mooring station (13 miles away) or to the Moelfra (8 miles away) according to wind.	A four-roomed cottage on the cliff to the north-east of the town has been obtained for isolation purposes. It is, however, unfurnished and unprovided with drainage or water-supply. There is no disinfecting apparatus in the district.	—	Dr. Copeman.	——
12	The pier head in ordinary times, but vessels from cholera-infected ports would, it is said, be boarded in the bay.	At Whiting Bank -	R.S.A. have joint use, with Cleator Moor, Frizington, and Egremont U.S.A.'s of the "Galemire" isolation hospital. But owing to its distance from the port it is not suitable for port purposes (for cholera).	No	Mr. T. W. Thompson.	R.S.A. consider that it is very unsatisfactory and inequitable that they should be responsible for the port of Whitehaven, and they would willingly forego the rates of the harbour and docks if they could be relieved of this responsibility.

App. A. No. 14.

On Precautions against the Infection of Cholera.

No. 14.

Precautions against the Infection of Cholera.

1. The Order of the Local Government Board, of 28th August 1890, now in force, gives certain special powers to Port and Riparian Sanitary Authorities, enabling them to deal with any cases of cholera brought into their districts, so as to prevent as far as possible the spread of the disease into the country. But it is to be remembered that cases of choleraic infection differ widely in severity, and that persons suffering only slightly from the disease, or incubating it, are likely to be landed at English sea-board and riparian towns, and to make their way to inland places. This has, in fact, occurred in former epidemics.

2. Former experience of cholera in England justifies a belief that the presence of imported cases of the disease at various spots in the country will not be capable of causing much injury to the population, if the places receiving the infection have had the advantage of proper sanitary administration; and, in order that all local populations may make their self-defence as effective as they can, it will be well for them to have regard to the present state of knowledge concerning the mode in which epidemics of cholera (at least in this country) are produced.

3. Cholera in England shows itself so little contagious, in the sense in which small-pox and scarlatina are commonly called contagious, that if reasonable care be taken where it is present, there is almost no risk that the disease will spread to persons who nurse and otherwise closely attend upon the sick. But cholera has a certain peculiar infectiveness of its own, which *where local conditions assist*, can operate with terrible force, and at considerable distances from the sick. It is characteristic of cholera (and as much so of the slight cases where diarrhœa is the only symptom as of the disease in its more developed and alarming forms) that *the matters which the patient discharges from his stomach and bowels are infected.* Probably under ordinary circumstances, the patient has no power of infecting other persons except by means of these discharges; nor any power of infecting even by them except in so far as these matters are enabled to taint the food, water, or air, which people consume. Thus, when a case of cholera is imported into any place, the disease is not likely to spread, unless in proportion as it finds, locally open to it, certain facilities for spreading by *indirect infection.*

4. In order rightly to appreciate what these facilities must be, the following considerations have to be borne in mind:—*first*, that any choleraic discharge, cast without previous thorough disinfection into any cesspool or drain or other depository or conduit of filth, is able to infect the excremental matters with which it there mingles, and probably, more or less, the effluvia which those matters evolve; *secondly*, that the infective power of choleraic discharges attaches to whatever bedding, clothing, towels, and like things, have been imbued with them, and renders these things, if not thoroughly disinfected, capable of spreading the disease in places to which they are sent for washing or other purposes; *thirdly*, that if, by leakage or soakage from cesspools or drains, or through reckless casting out of slops and waste water, any taint (however small) of the infective material gets access to wells or other sources of drinking-water, it can impart to enormous volumes of water the power of propagating the disease. When due regard is had to these possibilities of

n direct infection, there will be no difficulty in understanding that even a single case of cholera, perhaps of the slightest degree, and perhaps quite unsuspected in its neighbourhood, may, *if local circumstances co-operate*, exert a terrible infective power on considerable masses of population.

5. The dangers which have to be guarded against as favouring the spread of cholera-infection are particularly two. First, and above all, there is the danger of WATER-SUPPLIES which are in any (even the slightest) degree tainted by house refuse or other like kind of filth ; as where there is outflow, leakage or filtration, from sewers, house-drains, privies, cesspools, foul ditches or the like, into springs, streams, wells or reservoirs, from which the supply of water is drawn, or into the soil in which the wells are situate ; a danger which may exist on a small scale (but perhaps often repeated in the same district) at the pump or dip-well of a private house, or, on a large or even vast scale, in the case of public water-works. And secondly, there is the danger of breathing AIR which is foul with effluvia from the same sorts of impurity.

6. Information as to the high degree in which those two dangers affect the public health in ordinary times, and as to the special importance which attaches to them at times when any diarrhœal infection is likely to be introduced, has now for so many years been before the public, that the improved systems of refuse-removal and water-supply by which those dangers are permanently obviated for large populations and also the minor structural improvements by which separate households are secured against them, ought long ago to have come into universal use.

So far, however, as this wiser course has not been adopted in any Sanitary District, security must, as far as practicable, be sought in measures of a temporary and palliative kind.

(*a.*) Immediate and searching examination of sources and conduits of water-supply should be made in all cases where drinking water is in any degree open to the suspicion of impurity: and the water both from private and public sources should be examined. Where pollution is discovered, everything practicable should be done to prevent the pollution from continuing, or, if this object cannot be obtained, to prevent the water from being drunk. Cisterns should be cleaned, and any connexion of waste pipes with drains should be severed.

(*b.*) Simultaneously, there should be immediate thorough removal of every sort of house-refuse and other filth which has accumulated in neglected places ; future accumulations of the same sort should be prevented ; attention should be given to all defects of house drains and sinks through which offensive smells can reach houses ; thorough washing and lime washing of uncleanly premises, especially of such as are densely occupied, should be practised again and again.

7. It may fairly be believed that, in considerable parts of the country, conditions favourable to the spread of cholera are now less abundant than in former times; and, in this connexion, the gratifying fact deserves to be recorded that during recent years enteric fever, the disease which in its methods of extension bears the nearest resemblance of cholera, has continuously and notably declined in England. But it is certain that in many places such conditions are present as would, if cholera were introduced, assist in the spread of that disease. It is to be hoped that in all these cases, the local sanitary authorities will at once do everything that can be done to put their districts into a wholesome state. Measures of cleanliness, taken beforehand, are of far more importance for the protection of a district against cholera, than removal or disinfection of filth after the disease has actually made its appearance.

8. It is important for the public very distinctly to remember that pains taken and costs incurred for the purposes to which this Memorandum refers cannot in any event be regarded as wasted. The local conditions which would enable cholera, if imported, to spread its infection in this country, are conditions which day by day, in the absence of cholera, foster and spread other diseases: diseases, which are never absent from the country, and are, in the long run, far more destructive than cholera. Hence the sanitary improvements which would justify a sense of security against any apprehended importation of cholera would to their extent, though cholera should never reappear in England, give amply remunerative results in the prevention of those other diseases.

R. Thorne Thorne,
Medical Officer of the Board.

Local Government Board,
August 26th, 1892.

No. 15.

General Memorandum on the proceedings which are advisable in places attacked or threatened by Epidemic Disease.

General Memorandum on the Proceedings which are advisable in Places attacked or threatened by Epidemic Disease.

1. Wherever there is prevalence or threatening of cholera, diphtheria, fever, or any other epidemic disease, it is of more than common importance than the statutory powers conferred upon Sanitary Authorities for the protection of the public health should be well exercised by those Authorities, acting with the advice of their Medical Officers of Health.

2. Proper precautions are equally requisite for all classes of society. But it is chiefly with regard to the poorer population, therefore chiefly in the courts and alleys of towns, and at the labourers' cottages of country districts, that Local Authorities are called upon to exercise vigilance, and to proffer information and advice. Common lodging-houses, and houses which are sublet in several small holdings, always require particular attention.

3. Wherever there is accumulation, stink, or soakage of house-refuse, or of other decaying animal or vegetable matter, the nuisance should as promptly as possible be abated, and precaution should be taken not to let it recur. Especial examination should be made as to the efficient working of sewers and drains, and any defect therein, and any nuisance therefrom, or from auy foul ditches or ponds, should be got rid of without delay. The ventilation of sewers, the ventilation and trapping of house drains, and the disconnexion of cistern overflows and sink pipes from drains should be carefully seen to. The scavenging of the district, and the state of the receptacles for excrement and of ash-pits or dust-bins, will require close attention. In slaughter-houses, and wherever animals are kept, strict cleanliness should be enforced.

4. In the removal of filth during periods of epidemic disease, it is commonly necessary to employ chemical agents for reducing or removing the offence and harm which may be involved in the disturbance of the filth. In the removal of privy contents these agents are more particularly wanted if the disease in question be cholera or enteric fever. The chemical agent should be used liberally over all exposed surfaces from which filth has been removed. Unpaved earth close to dwellings, if it be sodden with slops or filth, ought to be treated in the same way.

5. Sources of water supply should be well examined. Water from sources which can be in any way tainted by animal or vegetable refuse, especially those into which there may be any leakage or filtration from sewers, drains, cesspools, or foul ditches, ought no longer to be drunk. Above all, where the disease is cholera, diarrhœa, or enteric fever, it is essential that no impure water be drunk.

The liability of leaky water-pipes to act as land drains and to receive foul matter as well as land drainage though their leaks is not to be overlooked. And such leaky pipes, running full of water with considerable velocity, are liable to receive, by lateral insuction at their points of leakage, external matters that may be dangerous. This latter fact is not recognised so generally as it should be; and ignorance of it has probably baffled many inquiries in cases where water services have in truth been the means of spreading disease.

If, unfortunately, the only water which for a time can be got should be open to suspicion of dangerous organic impurity, it ought at least to be boiled before it is used for drinking, but then not to be drunk later than 24 hours after it has been boiled. Filtering of the ordinary kind cannot by itself be trusted to purify water. It cannot be too distinctly understood that dangerous qualities of water are not obviated by the addition of wine or spirits.

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6. When there appears any probable relation between the distribution of disease and of milk supplies, the cleanliness of dairies, the purity of the water used in them, the health of the persons employed about them, and the health of the cows that furnish milk should always be carefully investigated. Even apart from any apprehension of milk being concerned in a particular outbreak of disease, it is desirable that English people should adopt the custom, which is always followed in some continental countries, of boiling all milk at once upon its reception into a house.

7. The washing and lime-whiting of uncleanly premises, especially of such as are densely occupied, should be pressed with all practicable despatch.

8. Overcrowding should be prevented. Especially where disease has begun, the sick-room should, as far as possible, be free from persons who are not of use to the patient.

Ample ventilation should be enforced. It should be seen that windows are made to open, and that they are sufficiently opened. Especially where any kind of infective fever has begun, it is essential, both for patients and for persons who are about them, that the sick-room and the sick-house be constantly traversed by streams of fresh air.

9. The cleanliest domestic habits should be enjoined. Refuse matters should be speedily removed or destroyed; and things which have to be disinfected or cleansed should always be disinfected or cleansed without delay.

10. Special precautions of cleanliness and disinfection are necessary with regard to infective matters discharged from the bodies of the sick. Among discharges which it is proper to treat as infective are those which come in cases of small-pox and scarlatina from the affected skin; in cases of cholera and enteric fever from the intestinal canal; in cases of diphtheria and scarlatina from the nose and throat; likewise, in case of any eruptive or other epidemic fever, the general exhalations of the sick. The caution which is necessary with regard to such matters must, of course, extend to whatever is imbued with them; so that bedding, clothing, towels, handkerchiefs, and other articles which have been in use by the sick may not become sources of mischief, either in the house to which they belong or in houses to which they are conveyed. So far as articles of this class can be replaced by rags or things of small value, it is best to use such things and burn them when they are soiled. Otherwise clothing and infected articles should be subjected to the disinfectant of the sick room or be removed for disinfection by heat.

In enteric fever and cholera the evacuations should be regarded as capable of communicating an infectious quality to any nightsoil with which they are mingled in privies, drains, or cesspools; and after such disinfection of them as is practicable, they should be disposed of without delay and under the safest conditions that local circumstances permit. They should not be thrown into any fixed privy receptacle, and above all, they must never be cast where they can run or soak into sources of drinking water.

11. All reasonable care should be taken not to allow infective disease to spread by the unnecessary association of sick with healthy persons. This care is requisite, not only with regard to the sick house, but likewise with regard to schools and other establishments wherein members of many different households are accustomed to meet.

12. If disease begins in houses where the sick person cannot be properly accommodated and tended, medical advice should be taken as to the propriety of removing him to an infirmary or hospital. Every Sanitary Authority should have in readiness a hospital for the reception of such cases.

Where dangerous conditions of residence cannot be promptly remedied, it will be best that the inmates, while unattacked by disease, remove to some safer lodging.

13. Privation, as predisposing to disease, may require special measures of relief.

14. In certain cases special medical arrangements are necessary. For instance, as cases of cholera in this country sometimes begin somewhat gradually in the comparatively tractable form of what is called "premonitory diarrhœa," it is essential that, where cholera has appeared, arrangements should be made for affording medical relief without delay to persons attacked, even slightly, with looseness of bowels. So, again, where small-pox is the prevailing disease, it is essential that all unvaccinated persons (unless they previously have had small-pox) should very promptly be vaccinated; and that re-vaccination should be performed in cases properly requiring it.

15. It is always to be desired that the people should, as far as possible, know what real precautions they can take against the disease which threatens them, what vigilance is needful with regard to its early symptoms, and what (if any) special arrangements have been made for giving medical assistance within the district. For the purpose of such information, printed hand-bills or placards may usefully be employed, and in cases where danger is great, house-to-house visitation by discreet and competent persons may be of the utmost service, both in quieting unreasonable alarm and in leading or assisting the less educated and the destitute parts of the population to do what is needful for safety.

16. The present memorandum relates to occasions of emergency. Therefore the measures suggested in it are essentially of an extemporaneous kind; and permanent provisions for securing the public health have, in express terms, been but little insisted on. It is to be remembered, however, that in proportion as a district is habitually well cared for by its Sanitary Authority, the more formidable emergencies of epidemic disease are not likely to arise in it.

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17. Provision by the public authority for disinfection by heat of bulky articles, and of those which cannot without injury be exposed to chemical agencies, ought always to be in readiness. Without such provision no complete disinfection can be effected. Partial and nominal disinfection, besides being wasteful, may be mischievous, as giving rise to a false security.

18. The following system of domestic disinfection may be commended to Sanitary Authorities who have already provided adequate public means for the disinfection and for the disposal of infected matters and things:—

(*a.*) For the purposes of the sick room, such as the reception of soiled handkerchiefs, sheets, and the like, as well as for the swabbing of floors, a valuable disinfecting solution may be may be made with perchloride of mercury. It is well to have this solution slightly acid, coloured also in such a way that it shall not readily be confused with drinks or medicines; and proper caution should be given to avoid accidents in its use. Sanitary Authorities will find it advantageous to have such a solution* prepared under the direct instructions of the

* A solution fitted for the desired purposes may be made with ½ oz. corrosive sublimate, 1 fluid oz. hydrochloric acid, and five grains of commercial aniline blue, in three gallons (a bucketful) of common water. It ought not to cost more than 3*d.* the bucketful, and should not be further diluted. The use of non-metallic vessels (wooden or earthenware house tubs or buckets) should be enjoined on those who receive it, and articles that have been soaked in it should be set to soak in common water for some hours before they go to the wash.

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Medical Officer of Health, and supplied of a uniform strength at the infected house upon the order of that officer.

(*b.*) In places provided with proper systems of excrement disposal, excrements of cholera and enteric fever, after being treated in detail with the same disinfecting solution in ample quantity, may be safely put into the ordinary closet; but special care as to the flushing of drains and sewers, and special frequency in the removal and exchange of excrement receptacles, will commonly be wanted. Where the only closet is one that communicates with a cesspool or privy pit, the best arrangement for the disposal of infected stools that under these improper local circumstances may be found practicable will have to be adopted.

(*c.*) A substance generally available in the removal of filth from privies and ashpits, and for application to foul earth and the like,* is sulphate of iron (green copperas), either in a strong solution made by stirring crystals of the salt with five or ten times their bulk of hot water, or in the form of powder, to which form the crystals may be readily brought after desiccation. This agent should be used in quantity sufficient to distroy all odour, and in the removal of filth accumulations it should be well mixed with successive layers of the matter to be removed. The dry form of application is to be preferred where masses of wet or semi-solid filth have to be dealt with.

(*d.*) For disinfection of the air of rooms, after the room has been prepared by the removal of persons, and of such articles as are best disinfected by heat, and by the closing of windows and crevices, sulphurous acid gas in ample quantity may be evolved, the doors being kept closed for six hours or more. The amount of sulphurous acid required for the disinfection of a moderate sized room can be obtained by burning 1½ lbs. of sulphur (roll brimstone) in a pipkin over a small fire placed in the middle of the room, with an old tray or the like to protect the flooring. These processes should be effected by skilled persons acting under the directions of the Medical Officer of Health.

(*e.*) After measures of disinfecting a room have been taken, all wall paper should be stripped from the walls and be burned, and the room ought to have its ceilings and walls thoroughly washed or lime whited.

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19. For detailed information on disinfection by heat, on hospital accommodation, and on small-pox, and on questions of school administration during the prevalence of infectious disease, see the Office Memoranda and Reports on these subjects.

R. Thorne Thorne,
Medical Officer.

Local Government Board,
Medical Department,
August 26th, 1892.

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* The removal of dangerous filth is here the object to be attained. It cannot confidently be stated that either the iron salt or any available substance will effect a true disinfection of such masses of filth as are here in question.

No. 16.

CHOLERA ORDER of September 6th, 1892.

To all Port Sanitary Authorities; To all other Sanitary Authorities as defined in our Order of the 28th day of August 1890 hereafter recited; to all Masters of Ships; and to all Others whom it may concern.

WHEREAS we, the Local Government Board, are empowered by section 130 of the Public Health Act, 1875, and section 2 of the Public Health Act, 1889, from time to time, to make, alter, and revoke such regulations as to us may seem fit, with a view to the treatment of persons affected with cholera, and preventing the spread of cholera, as well on the seas, rivers, and waters of the United Kingdom, and on the high seas within three miles of the coasts thereof, as on land, and may declare by what Authority or Authorities such regulations shall be enforced and executed;

And whereas by an Order dated the 28th day of August 1890, we, the Local Government Board, made regulations under section 130 of the Public Health Act, 1875, and section 2 of the Public Health Act, 1889, with a view to the treatment of persons affected with cholera, and preventing the spread of cholera;

And whereas Article 12 of those regulations provides as follows:—

"The Medical Officer of Health shall, as soon as possible after any "such ship has been certified to be infected with cholera, "examine every person on board the same, and in the case of "any person suffering from cholera or from any illness which "the Medical Officer of Health suspects may prove to be "cholera, shall certify accordingly; and any person who shall "not be so certified by him shall be permitted to land immedi- "ately on giving to the Medical Officer of Health his name "and place of destination, stating, where practicable, his address "at such place.

"The name and address of any such person shall forthwith be given "by the Medical Officer of Health to the clerk to the Sanitary "Authority, and such clerk shall thereupon transmit the same "to the Local Authority of the district in which the place of "destination of such person is situate;"

And whereas the above-recited Order has been amended by Orders made by us and dated the 29th and 31st days of August 1892, by which further regulations are made under the said sections; and it is desirable that the provisions of the last-mentioned Orders should be consolidated and amended:

Now, therefore, we, the Local Government Board, do, by this our Order, in the exercise of the power conferred on us by the Public Health Act, 1875, the Public Health Act, 1889, and every other power enabling us in that behalf, revoke the said Orders dated the 29th and 31st days of August 1892 (except so far as relates to any proceedings taken or

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Cholera Order of September 6th, 1892.

commenced thereunder), and make the following regulations, and declare that they shall be duly enforced and executed:—

Article I.—Article 12 of the said Order dated the 28th day of August 1890 shall be amended by the omission therefrom of the words "and any person who," and the following words to the end of the first paragraph, and the insertion of the following words in place thereof: "and a person who shall not be so certified shall not be "permitted to land, unless he satisfy the Medical Officer of Health as "to his name, place of destination, and address at such place."

Article II.—Where a ship is not infected with cholera, but has passengers on board who are in a filthy or otherwise unwholesome condition, or has come from a place infected with cholera, the Medical Officer of Health may, if in his opinion it is desirable with a view to checking the introduction or spread of cholera, give a certificate in duplicate in the following form, or to the like effect, and shall deliver one to the master, and retain the other or transmit it to the Sanitary Authority:—

Certificate.

day of , 189 .

Sanitary Authority of .

I hereby certify that I have examined the ship from now in the port of , and that she has passengers on board in a filthy or otherwise unwholesome condition [*or* has come from a place infected with cholera], and that, in my opinion, it is desirable with a view to checking the introduction or spead of cholera, that the persons on board the ship should not be allowed to land unless they satisfy me as to their names, places of destination, and addresses at such places.

Signed _____

Medical Officer of Health (or Medical Practitioner appointed by the Sanitary Authority).

Article III.—When such certificate has been given, no person on board the ship shall leave or be allowed to leave the same unless he satisfy the Medical Officer of Health as to his name, place of destination, and address at such place; and such name and address shall forthwith be given by the Medical Officer of Health to the clerk to the Sanitary Authority, and such clerk shall thereupon transmit the same to the Local Authority of the district in which the place of destination of such person is situate.

In this Article the term "Local Authority" means any Urban or Rural Sanitary Authority, and in the administrative county of London any Sanitary Authority as defined by the Public Health (London) Act, 1891.

Article IV.—If the Medical Officer of Health have reason to believe that any ship coming or being within the jurisdiction of the Sanitary Authority is infected with cholera, or has come from a place infected with cholera, he may direct the bilge water to be pumped out before such ship enters any dock or basin; and on the Sanitary Authority providing a proper supply of water for drinking and cooking purposes for persons on board the ship, he may direct all casks or tanks on board the ship, containing water for the use of such persons to be emptied and cleansed, and the master shall cause the said directions to be carried into effect.

Article V.—This order shall be read as one with the said Order dated the 28th day of August 1890, and words herein shall have the same meaning as words in that Order.

Given under the seal of office of the Local Government Board this sixth day of September, in the year one thousand eight hundred and ninety-two.

(L.S.) Henry H. Fowler,
President,

Hugh Owen,
Secretary.

Notice.—The Public Health Act, 1875, provides, by section 130, that any person wilfully neglecting, or refusing to obey or carry out or obstructing the execution of any regulation made under that section, shall be liable to a penalty not exceeding *fifty pounds*.

No. 17.

App. A. No. 17.

On Foreign Epidemics and Quarantine; by Mr. Simon (1865).

REPRINT from the EIGHTH ANNUAL REPORT of the MEDICAL OFFICER of the PRIVY COUNCIL, 1865; being COMMENTS by Mr. SIMON (now Sir JOHN SIMON, K.C.B.) on FOREIGN EPIDEMICS and QUARANTINE.

THE precautions, generally, which may be taken against contagious diseases are of two kinds: first, if possible, to prevent the entrance of the contagion; secondly, if the contagion be present, to annihilate as far as possible the circumstances which favour its spread. And thus, as regards cholera, a first and incalculably important question to be answered by those who have to care for the public health of a country is the question whether, by any measures of quarantine, they can provide that all contagion of the disease shall be kept outside the limits of their land.

Subject to one qualification, which is not an important one for the present argument, it may, I think, be accepted as certain that quarantine, conducted with extreme rigour, and with the precision of a chemical experiment, will keep cholera out of any part of Europe in which the extremely difficult conditions can be absolutely fulfilled;* and thus, if I speak to the dry question of medical practice, I have no hesitation in saying that England ought to resist cholera by quarantine. On the other hand, though I cannot pretend to discuss with any kind of authority the non-medical aspects of the question, it would be mere pedantry for me to ignore that facts which are of common notoriety, and considerations which are of common sense, conflict with that medical conclusion. A quarantine which is ineffective is a mere irrational derangement of commerce; and a quarantine, of the kind which ensures success, is more easily imagined than realised. Only in proportion as a community lives apart from the great highways and emporia of commerce, or is ready and able to treat its commerce as a subordinate political interest, only in such proportion can quarantine be made effectual for protecting it. In proportion as these circumstances are reversed, it becomes impossible to reduce to practice the paper plausibilities of quarantine. The conditions which have to be fulfilled are conditions of national seclusion, and the fulfilment of such conditions by England would involve fundamental changes in the most established habits of the country.

In order to illustrate this view, the medical postulates of quarantine deserve to be considered in detail. Quarantine, purporting to be effectual, cannot rest satisfied with excluding from entry such persons as are obviously sick, but, indispensably for its purpose, must also refuse to admit the healthy till they shall have passed in perfectly non-infectious circumstances at least as many days of probation as the disease can have days of incubation or latency, this condition often

* The qualification with which the above opinion is guarded relates to the uncertainty how far the mysterious influence which starts, and perhaps accompanies, each pandemic extension of cholera, is an influence which creates new centres of "spontaneous generation" for the disease. As regards Europe, there seem to be strong presumptions against the likelihood that any such new centres are created. But this negative cannot be deemed absolutely certain; and of course the qualification becomes more and more important, in proportion as the country to which the question applies is near to those countries where cholera first had its beginning.

involving as its consequence that, if one case of disease arise among a number of persons in quarantine, the whole number of apparently healthy must recommence their period of probation, and this perhaps again and again. Now, setting aside as not essential to quarantine the cruelties which its mal-administration involves and which in practice are almost identified with its exercise; criticising only the conditions which quarantine, if it is to be effective, must involve; and, for the moment, not even counting as an objection the cost of that gigantic establishment which has to be permanently maintained in order to meet occasional exigencies; I here insist only upon the restrictions. Considering what they, when really carried into effect, must involve—what inconvenience to persons, what interruption to commerce, and on how vast a scale, and for what indefinite duration of time, no one can expect, in regard of great trading communities, that governments, if they go so far as to enact, will have much success in enforcing quarantine. Against the efficiency of it when enacted there operate some of the strongest of all law-breaking influences; on the one hand, instincts of contempt for the narrow self-protectiveness which it represents, and, on the other, those eager commercial interests which now mainly govern the world. The latter, in proportion as they are affected, elude the restrictions which would embarrass them. Contraband of quarantine, like ordinary smuggling, is developed as soon as the inducements for it are considerable. And thus, practically speaking, where great commercial countries are concerned, it can scarcely be dreamt that quarantine restrictions will be anything better than elaborate illustrations of leakiness.

In respect of England, moreover, there are other facts to be stated. In 1832–33, when some sort of quarantine against cholera was adopted here, the results gave no encouragement to a repetition. Then followed the erroneous belief (which subsequent better knowledge has corrected) that the spread of cholera is unaffected by human intercourse. Under these and other influences the thought of quarantine in England became more and more obsolete, and the possibility of enforcing it, if ever so much desired, fell more and more towards nothingness. Probably there was the practical conviction that, against any contagious disease current on the continent of Europe, quarantine of the utmost strictness which England could hope to attain would not give results worth the sacrifice. I daresay that quarantine in England was never otherwise than very lax. And at all events for many years past it has, in every medical sense, been abolished. Also with its virtual extinction, the establishment for giving it effect has declined. As successive governments advanced further and further in relinquishing what probably at its best was only a sham of quarantine, corresponding reductions of establishment were made. And the result of the entire process may be told in these very few words—that, at the present moment, England has not in readiness the means of properly quarantining even a single ship.* It is not for me to say that this state of things may be deemed final. But if reversal of the policy which it expresses were ever so much desired, it could not be effected offhand. Enormous first expenditure of money in creation of proper lazarets would be wanted, as well as subsequent very large annual outlays for maintaining the

* It may be proper to mention that the ceremonies to which, under the name of quarantine, certain transatlantic ships are subjected on their arrival in this country, have not, properly speaking, any medical significance in relation to this country, but are part of an international obligation contracted for commercial reasons.

necessary establishments. And the time which would be required for bringing the organisation into work forbids the supposition that this could ever be done on emergency.

So, for England, under present circumstances, quarantine against cholera, as existing in the countries which are nearest to us, is a precaution of which there can be no serious thought. Were the country ever so ready to endure those extreme restrictions, without which the whole thing is fruitless and absurd, the means for imposing them do not exist.* To extemporise a cordon sanitaire is simply and totally impossible, and no partial quarantine can be relied on for national purposes. Not only as regards cholera, but generally as regards all contagious disease, the position which now has to be recognised and dealt with is, that contagions current on the continent of Europe must be deemed virtually current in England.

* When cholera last year broke out so vehemently at Alexandria, and was hitherto not in Europe, it would have been, comparatively speaking, a trifle to quarantine arrivals from that one port, not only because of their being few, in comparison with the innumerable arrivals from the ports of continental Europe, but also because, with the long voyage, the object of quarantine would generally have accomplished itself before arrival. And medically, of course, such a precaution was to be desired. But while my Lords still had it under consideration, whether to establish this amount of quarantine, and to provide the means of conducting it, cholera had already almost ceased at Alexandria, and had shown itself in other various ports. Before proper quarantine arrangements against Alexandria could have been organised, no quarantine would have been self-consistent which had not been a quarantine against France, Turkey, Spain, Italy, and Germany, as well as against our own possessions of Malta and Gibraltar; and, doubtless, the contagium of cholera was in Southampton long before any effective arrangements could have been called into existence for excluding it.

No. 18.

SUMMARY TABLE showing PRINCIPAL POINTS of CONTRAST and RESEMBLANCE between the RESULTS of the VENICE CONFERENCE 1892, and the RESULTS of the PARIS CONFERENCE (up to May 28), 1892.

INFECTED VESSELS. Article 3.

VESSELS WITHOUT EITHER A DOCTOR OR MEANS OF DISINFECTION.

Results of the Venice Conference, 1892.	Results of the Paris Conference (up to 28th May), 1892.
(*a.*) The actual cholera sick to be disembarked and removed to hospital.	(*a.*) The same.
(*b.*) The linen, clothing, &c., of passengers and crew to be disinfected.	(*b.*) Ditto.
(*c.*) The vessel to be disinfected.	(*c.*) Ditto.
(*d.*) All the other passengers to be regarded as suspect, to be disembarked, isolated in groups, and kept under observation.	(*d.*) Ditto.
(*e.*) These passengers to be detained at Moses' Wells for a period of five days. This period of detention may be reduced at the discretion of the local authority.	(*e.*) These passengers to be detained at Moses' Wells for a period varying, under a sliding scale, from forty-eight hours to five days. The conditions controlling these shorter detentions are no longer at the discretion of the local authority, but are strictly defined.

VESSELS WITH A DOCTOR AND MEANS OF DISINFECTION.

Results of the Venice Conference, 1892.	Results of the Paris Conference (up to 28th May), 1892.
(*a.*) The actual cholera sick to be disembarked and removed to hospital.	(*a.*) The same; but it is the doctor on board who is to decide who are the persons actually suffering from cholera.
(*b.*) The linen, clothing, &c., of passengers and crew to be disinfected.	(*b.*) The same; but the process may be carried out on board. If cholera has appeared only among the crew, the linen, &c., of the crew only to be disinfected.
(*c.*) The vessel is to be disinfected. This disinfection may, in the case of postal-vessels and troop-ships, be limited to certain portions of the vessel; but this is only at the discretion of the local authority.	(*c.*) Only limited and strictly-defined portions of the vessel need be disinfected, and the doctor on board is to decide which are such portions. No detention of a vessel for disinfection purposes can exceed twenty-four hours.
(*d.*) All the rest of the passengers to be detained under observation at Moses' Wells, unless in the case of postal-vessels and troop-ships; the number to be thus disembarked and detained may be limited. Any such limitation to be at the discretion of the local authority.	(*d.*) No passengers other than cholera patients need be landed for observation. No quitting of the vessel to be compulsory except when necessary for disinfecting a special portion of the vessel. Even then the people in question can go on board a ship alongside; they have the right to return to their vessel within twenty-four hours at the outside, and if they should be landed, they will be placed for the same number of hours in a building distinct from the cholera hospital.
(*e.*) All persons on board are regarded as "suspects," unless the local authority chooses to decide, in the case of postal-vessels and troop-ships, that the number may be limited to those who have occupied certain undefined parts of the vessel only.	(*e.*) No one to be regarded as among the "suspects," and to be dealt with as such, except those whom the doctor on board declares to have been in direct contact with a cholera patient since the commencement of his illness, or with articles capable of transmitting the infection of cholera.

App. A. No. 18.

Principal Points of Contrast and Resemblance between the Results of the Venice and Paris Conferences.

Results of the Venice Conference, 1892.	Results of the Paris Conference (up to 28th May), 1892.
(*f*.) The detention under observation of the "suspects" at Moses' Wells is to last five days, unless the period be diminished at the discretion of the local sanitary authority.	(*f*.) The detention of the limited number of "suspects" may be either on the vessel itself or on a ship alongside. It will vary, according to a second sliding scale, from a period of 24 to 48 hours to five days, according to the date of the occurrence of the last case of cholera. Even these diminished periods of detention may be further reduced at the discretion of the local sanitary authority. Any detention of the vessel for disinfecting purposes is to be included in the period for the detention under observation.
(*g*.) The vessel shall, after completing its disinfection, be allowed to pass the Canal in quarantine if it abandons its "suspects" as well as its cholera patients.	(*g*.) The vessel shall, after completing its disinfection, which is not to exceed twenty-four hours in duration, be allowed to pass the Canal in quarantine, if it abandons its "suspects" (as limited by definition under *e*) as well as its cholera patients.

N.B.—According to the Report of Mr. Lowther and Dr. Mackie (31st January 1892), only two, out of a total of 16,491 vessels would, during the preceding five years, have come within any of these restrictions as being "navires infectés"; and Mr. Miéville's table of 15th December 1891, shows that even as regards these two vessels the detention for disinfection and for the limited number of "suspects" under observation combined could not have exceeded "24 à 48 heures," and might have been further reduced by the local authority.

(Translation.)

Procès-Verbal respecting the Sanitary Convention of Venice of January 30, 1892.

Procès-Verbal respecting the sanitary convention of Venice of January 30, 1892.

As the result of communications made by the Austro-Hungarian Government, the undersigned Delegates of Austria-Hungary, France, and Great Britain have been appointed by their respective Governments to meet at Paris to examine together those points which the Government of Her Britannic Majesty require to be settled as a condition of their accession to the International Sanitary Convention, signed at Venice on the 30th January 1892.

The undersigned delegates observe that the divergence of views which has hitherto delayed the signature of the Convention by the British Government bears on the interpretation to be given to the provisions of Articles 2 and 3 of the Special Regulations respecting cholera, inserted in Annex IV. to the Convention.

After examining these articles, they agree that, without altering the essential nature of the above-mentioned Articles, it is possible, in order to meet the views of the British Government, to give to those Articles a more precise and explicit form. They have, therefore, agreed to substitute the two following Articles for those similarly numbered 2 and 3 in the Regulations headed, "Regulations against Cholera," inserted in Annex IV. to the International Sanitary Convention of Venice:—

Article II.

Suspected Ships.—That is, such as have had a case of cholera on board at the moment of starting or during the voyage, but no fresh case within seven days. Such ships shall be treated differently, according as they have or have not a doctor and a disinfecting apparatus ("étuve") on board.

(*a*.) Ships having on board a doctor, and a disinfecting apparatus ("étuve") fulfilling the desired requirements, will be allowed to pass through the Canal in quarantine under the conditions stated in the Transit Regulations.

(*b.*) Other suspected ships, having neither a doctor nor a disinfecting apparatus ("étuve"), will, before being allowed to pass through the Canal in quarantine, be stopped at Moses' Wells during the time necessary for disinfecting the soiled linen, body linen, and other susceptible articles, and for ascertaining that the ship is in [good] sanitary condition.

In the case of a mail steamer, or of a packet specially engaged in the carriage of passengers, not having a disinfecting apparatus ("étuve") on board, but carrying a doctor, transit in quarantine will be allowed if the local authority has an assurance, derived from an official certificate, that sanitary measures and disinfection have been properly carried out, either at the place of departure or during the voyage.

In the case of mail steamers or of packets specially engaged in the carriage of passengers, without a disinfecting apparatus ("étuve"), but carrying a doctor, free pratique may be granted at Suez after the operation of disinfection has been completed, if the last case of cholera occurred more than fourteen days previously, and if the state of the ship is satisfactory.

In the case of ships having had a voyage of less than fourteen days, passengers for Egypt shall disembark at Moses' Wells and be isolated for twenty-four hours, and their soiled linen and the effects they have used shall be disinfected. They will then receive free pratique.

Vessels having had a passage of less than fourteen days wishing to obtain free pratique in Egypt will also be stopped twenty-four hours at Moses' Wells.

In cases where the cholera has occurred exclusively among the crew disinfection will extend only to the soiled linen of the crew, but it will extend to all the soiled linen of the crew, and to the part occupied by the crew.

Article III.

Infected Ships.—That is to say, those which have cholera on board, or which have had fresh cases of cholera within seven days. They are divided into ships without a doctor and disinfecting apparatus ("étuve"), and ships with a doctor and disinfecting apparatus ("étuve").

(*a.*) Ships without a doctor and a disinfecting apparatus ("étuve") will be detained at Moses' Wells; persons suffering from cholera or choleraic diarrhœa will be disembarked, and isolated in a hospital. Disinfection will be carried out in a thorough manner. The other passengers will be disembarked, and isolated in groups of as few as possible, in order that the whole number may not be affected by a particular group, should cholera occur. Soiled linen, effects that have been used, the clothing of the crew and of the passengers will be disinfected as well as the ship.

It is clearly understood that there is no question of discharge of merchandize, but only of disinfecting the infected portion of the ship.

The passengers will remain for five days at the establishment at Moses' Wells; in cases where the cholera occurred several days previously, the period of isolation will be shortened. The period in question will vary according to the date of the occurrence of the last case.

Thus, if the last case occurred within seven days, the period of observation shall be forty-eight hours; if within six days, the observation will last three days; if within five days, the observation

will last four days ; if within less than five days, the observation will last five days.

(*b.*) *Ships with a Doctor and Disinfecting Apparatus* ("*Étuve*").—Ships with doctors and stoves ("étuves") will be detained at Moses' Wells.

The ship's doctor will declare on oath which persons on board are suffering from cholera or choleraic diarrhœa. These sick persons will be disembarked and isolated.

After the disembarkation of these sick, the soiled linen of the rest of the passengers and of the crew will undergo disinfection on board.

When cholera has occurred among the crew only, the disinfection of the linen shall extend to that of the crew only, and to the linen of the parts occupied by the crew.

The ship's doctor will also indicate on oath the part or compartment of the ship and the section of the hospital in which the patient or patients have been conveyed. He will also declare, on oath, which persons have have been in communication with the choleraic sick after the first appearance of the disease, either by direct contact, or by contact with articles capable of conveying infection.

These persons alone shall be considered as "suspect."

The part or compartment of the ship and the section of the hospital in which the patients have been conveyed will be thoroughly disinfected. By "part of the ship" is understood the cabin of the patient, the adjoining cabins, the passage of the cabins, the deck, and the parts of the deck which the patient or patients may have occupied.

If it is found impossible to disinfect the part or compartment of the ship which has been occupied by persons suffering from cholera or choleraic diarrhœa without disembarking the persons declared to be "suspect," these persons will be placed on another ship specially set apart for this purpose, or disembarked and lodged in the sanitary establishment provided for in Annex I. of the Convention under the title, "*Organization of Superintendence and Disinfection at Suez and at Moses' Wells*," without coming in contact with the patients, who will be placed in the hospital.

The duration of this stay on the ship or on land for disinfection shall be as brief as possible, and shall not exceed twenty-four hours.

These suspects shall undergo observation, either on their own ship or on the ship set apart for the purpose ; the period of this observation shall vary according to the following Table :—

When the last case of cholera occurred in the course of the 7th, 6th, or 5th day before reaching Suez - -	The observation shall be from 24 to 48 hours.
If it occurred in the course of the 4th day before reaching Suez -	The observation shall be from two to three days.
If it occurred in the course of the 3rd day before reaching Suez - -	The observation shall be from three to four days.
If it occurred in the course of the 2nd day before reaching Suez - -	The observation shall be from four to five days.
If it occurred one day before reaching Suez - - - - -	The observation shall be of five days.

The time occupied by disinfecting operations is included in the period of observation.

Passage in quarantine may be granted before the expiry of the periods above indicated if the sanitary authority judges it possible ; it will in every case be granted when the disinfection is completed, if the vessel abandons, in addition to her patients, the persons above defined as "suspect."

A stove ("étuve") placed on a pontoon may come alongside the ship to expedite the disinfecting operations.

Infected ships wishing to obtain free pratique in Egypt are detained for five days at Moses' Wells, reckoning from the last case which occurred on board.

In consequence of the interpretation placed on the provisions of Articles 2 and 3, as originally drafted by the Venice Conference, the undersigned Delegates have been obliged to modify the wording of the following provisions in order to bring the whole into harmony :—

I. *Regulation against Cholera, Article* 4.

The different groups of persons admitted to the sanitary station shall be separated from one another according to date of arrival, and the sanitary condition of each group.

Persons having cholera or choleraic diarrhœa are strictly separated from other persons, and receive the medical treatment which their condition requires.

Cholera convalescents, however many days they may have spent at the sanitary station, receive free pratique only on the declaration of the doctor of the said station, to the effect that there is no danger in granting it.

The bodies of those who have died of cholera shall be buried in the cemetery attached to the sanitary station, or, in default of a cemetery, in an isolated spot, with all requisite precautions. The depth of the grave must be 2 metres.

The apartments tenanted by cholera patients in the sanitary stations shall, on being vacated, be disinfected with the greatest care.

II. Annex I. to the Convention, under the following heading :—

Organization of Superintendence and of Disinfection at Suez and at Moses' Wells.

* * * * *

The disinfecting and isolating station at Moses' Wells shall contain :—

1. Three disinfecting stoves ("étuves"), one of which shall be on a pontoon.

2. An isolating hospital with twelve beds for persons suffering from cholera or from choleraic diarrhœa. This hospital shall be so arranged that the patients, male and female, are isolated from one another.

3. Buildings, hospital tents, or ordinary tents, for persons who are landed, not included in the foregoing paragraph.

4. A sufficient number of baths and shower-baths ("douches-lavages").

5. Buildings necessary for the common services, the medical staff, the guards, &c., a store, and a laundry.

6. A reservoir of water.

7. The various buildings shall be so arranged that no contact be possible between invalids, infected or suspected objects, and other persons.

III. Annex III. to the Convention, under the following heading :—

Composition, powers, and working of the Maritime, Sanitary, and Quarantine Board of Egypt.

(Alterations in the Regulations for maritime, sanitary, and quarantine police.)

* * * * *

Article 32 (ex. 37).

If, during the isolation of persons landed, a fresh doubtful or decided case of cholera occurs among the isolated persons, the period of isolation

App. A. No. 18.

Procès-Verbal respecting the Sanitary Convention of Venice of January 30, 1892.

recommences for the group of persons who were in contact with the person attacked.

IV. Annex V. to the Convention, under the following heading :—

Precautionary Measures to be taken on board Ships on departure, during the passage and on arrival at Suez.

* * * * *

III. Measures to be taken on arrival at Suez :—

1. All ships shall undergo a medical visit before entering the Suez Canal.

2. This visit shall be made by the sanitary authority of Suez.

3. If the ship is infected, the persons suffering from cholera, or classed as doubtful, shall be disembarked and isolated in a special building near Suez.

Persons having had choleraic symptoms, notably choleraic diarrhœa, shall be classed as doubtful.

4. All contaminated objects and the following objects shall be disinfected before the entry of the ship into the Suez Canal, namely, clothes, bed clothes, mattresses, carpets, and other objects which have been in contact with the patient, the clothes of those who have tended him, the objects in the patient's cabin and in the adjacent cabins, the passage to those cabins, the deck, or the parts of the deck which the patient may have occupied.

In regard to the manner of communicating to the other Governments which took part in the Venice Conference the new declaratory drafting of Articles 2 and 3 of the "Regulations against Cholera" and the modifications of detail made in the wording of the Annexes of the Convention, which are reproduced above, the undersigned Delegates have agreed upon the following :—

They are of opinion that the communication of the above-mentioned modifications to the said Powers should be intrusted to the care of the Austro-Hungarian Government, begging them, should they approve, to substitute them for the former texts of the Annexes in the ratifications of the Sanitary Convention, signed at Venice the 30th January, 1892.

It is understood that the communication to be made by the Cabinet of Vienna shall be supported, as regards these Governments, by a note from the Governments of France and of Great Britain.

The undersigned Delegates call attention to the fact that the term fixed by the Convention for the exchange of the ratification expires on the 1st August next.

Having observed, moreover, that in Annex IV. of the diplomatic document containing the said Convention the "Regulations concerning the Formation of a Corps of Sanitary Guards" have been omitted, as the Secretaries of the Conference informed the Delegates on the 25th February, 1892, they express the opinion that the Austro-Hungarian Government should likewise transmit to the Powers the complete text of the Convention and of the Annexes, printing in distinguishing type the changes of form resulting from the present Minute.

In faith whereof, the undersigned Delegates have drawn up the present Minute in three originals at Paris, the 9th June 1892.

(Signed) E. Constantine H. Phipps.
R. Thorne Thorne.
Kuefstein.
Camille Barrère.
D. Brouardel.
A. Proust.

APPENDIX B.

No. 1.

REPORT on the ETIOLOGY OF TYPHOID FEVER; by DR. KLEIN, F.R.S.

On the Etiology of Typhoid Fever; by Dr. Klein, F.R.S.

THE discovery in 1880 by Eberth of a particular species of bacillus in connexion with the fever indifferently styled "enteric" and "typhoid." and Gaffky's subsequen texhaustive study* of this so-called bacillus of typhoid fever, gave rise to debate which has continued to the present day. The fact as to the almost constant presence of this particular bacillus in the mesenteric glands and the spleen of persons dead from enteric fever, has of course been universally accepted: of this there could be no question. But there remains a not inconsiderable number of observers, who recognise certain important difficulties which stand in the way of accepting this bacillus as the *vera causa* of typhoid fever. These difficulties may be grouped under the following headings:—

ENTERIC FEVER BACILLUS.

Its specificity queried:

(*a*.) The exhaustive researches of Gaffky (l.c.) and of many other observers have shown that the "typhoid bacillus" is not at any stage of enteric fever present in the blood of persons affected with that malady. Thus, Gaffky paid particular attention to this question, in reference to a considerable number of cases of clinically well defined enteric fever. The blood was examined by him during the first, second, and third week, in coverglass specimens and by culture experiments, but was found practically free of organisms. Judging by its general symptoms enteric fever would properly rank amongst the blood diseases, and a priori it would be expected that, as in malarial fever and in relapsing fever,† the microbe of the disease would be present in the blood. The absence therefore from the blood of enteric fever of the particular bacillus which is present in abundance in the mesenteric glands and spleen, has afforded ground for hesitation in accepting the "typhoid bacillus" as the essential cause of this disease.

Not found in blood;

(*b*.) The etiology of typhoid fever points strongly to a spore state of the microbe, whichever that may be, upon which the disease depends. Thus, the very prolonged vitality of enteric fever infection outside the animal body, in sewage, in water, and in the soil, seems to demand a spore state of the hypothetical microbe of this disease. Liebermeister in his text book on Special Pathology considers the spore state of the typhoid microbe as essential for its acceptance as the cause of enteric fever; and he lays stress on Eberth's and Gaffky's statements, that the typhoid bacillus is capable of forming spores. Various other writers on the etiology of typhoid fever have taken the same view. But it has been conclusively shown by Buchner, and many others, that so far as direct observations of the typhoid fever bacillus in the tissues, and in artificial cultivations, enable us to draw any conclusion, this *bacillus does not form spores*. There is nothing easier than to show that the juice of the

nor proved to form spores.

* Mittheil aus dem Kais. Gesundheitsamte, Band II., Berlin, 1884, wherein Gaffky minutely describes this bacillus obtained by him in pure culture from the spleen and the mesenteric glands of persons dead of typhoid fever.

† In these two fevers, the specific microbes (the malarial plasmodium and the spirillum of Obermaier respectively) are during the febrile stage abundantly present in the blood, and then gradually disappear from the blood to hide, as it were, and to pass certain phases in the spleen.

mesenteric glands or of the spleen of a case of typhoid fever (fatal about the end of the second or during the third or fourth week), contains in cover-glass specimens and in culture a considerable number of this particular species of bacillus. Nevertheless, all tests that are generally successfully used for the demonstration of real spores fail in this case. The various methods for staining spores do not bring out in these bacilli from the human subject anything that one can identify with spores. Thus, the experiment of thoroughly drying the above juices in a thin film, as also of drying a thin film of a culture therefrom (whatever the culture medium or whatever the age of the culture), invariably prevents growth of the enteric fever bacillus thus treated; whereas had spores been contained in the specimens so dealt with, they should have resisted the process. Similarly heating any culture of the typhoid fever bacillus to 60–62° C. for 10 minutes, always produces death of the microbes; whereas spores had they been present should have easily resisted even much higher temperature. The only condition of cultivation under which the typhoid fever bacillus shows an appearance suggestive of spores is culture on potato, and it was the appearance of the bacillus under this condition of cultivation which induced Gaffky to believe in its ability to form spores. Cultivated on potato for a few days the bacillus of typhoid fever in most instances shows either at one or at both ends, or in the middle of the microbe, a highly refractive globule, which Gaffky took for a spore. And when stained in coverglass specimens such a bacillus shows either a central or terminal deeply stained granule. In the former case, especially, there is a superficial likeness to a bacillus bearing a central spore; but on further examination it is easily shown that neither the bright globule of the bacillus in the fresh unstained state, nor the deeply stained granule of the dried and stained specimens, is in truth anything of the nature of a spore. For neither in the manner in which these granules stain, nor in the behaviour of the bacilli grown on potato cultures, is there, after drying and subjection to heat, any result that would justify their being considered as spores. As already stated, these bacilli when grown on potato, just like those grown in other media (broth, gelatine, agar), succumb to drying and to heating to 60–62° C. It is now generally admitted by bacteriologists that *the typhoid bacillus does not form spores.*

Difficult of identification.

(*c.*) A third not unimportant consideration that is urged against acceptance of the typhoid bacillus as the *vera causa* of enteric fever is the difficulty of its recognition and distinction from other species. There is no difficulty, it is admitted, in identifying it in coverglass specimens and cultivations from material of the mesenteric glands and the spleen obtained at a post-mortem of a case of enteric fever—death having occurred between the end of the second and the end of the fourth week. But attempt to identify this bacillus in the contents of the intestines, or in the stools of a typhoid patient, is an altogether different matter. Koch doubts the ability of most people to do this with any degree of certainty, and especially he regards with suspicion the statements of various observers who profess to have demonstrated the presence of the typhoid bacillus in drinking water that was under suspicion of having conveyed the contagion of typhoid fever. In this he is largely supported by other competent persons who have given attention to the subject. There is, however, no insuperable difficulty in demonstrating the presence of the typhoid fever bacillus in the characteristic stools of cases of enteric fever, despite the mistakes which have only too frequently been made, owing to the insufficient experience of particular observers in differentiating the typhoid fever bacillus from other

similar microbes. Babes,* for instance, who enumerates a number of "varieties" of the typhoid bacillus isolated from cases of typhoid fever, made no such mistake. The "varieties" with which he worked did indeed show some slight differences one from another, but these differences were too slight to constitute varieties properly so called. They were one and all the true typhoid fever bacillus, and were certainly distinct from other species of bacillus with which confusion has been made.

Confusion with bacillus coli.

The organism with which the typhoid fever bacillus has most frequently been confounded is the bacillus coli communis of Escherich. This species is separately treated in a report in this volume by Dr. Cautley, and I need here but allude generally to the fact that bacillus coli is a common putrefactive microbe, and a constant inhabitant of the large intestine, and occasionally the ileum, of man and other animals. Its distribution, therefore, in water, air, and soil—media which are apt to become easily contaminated with the excreta of man, and particularly of lower animals—is a very wide one. Now the bacteriologists of the French School, amongst whom Arloing, Rodet, and Roux may be particularly mentioned, finding themselves unable to differentiate, by morphological, cultural, and other characters, the bacillus of typhoid fever and bacillus coli, have concluded that the two organisms are really only varieties of one single species and are mutually interchangeable. Thus, they believe that the common putrefactive and harmless bacillus coli, which, in the nature of things, is a constant inhabitant of cesspools and sewage, is potentially the pathogenic typhoid fever bacillus. And conversely they believe that this latter bacillus, discharged from the bowels of a case of typhoid fever and passed into cesspool or drain, may become attenuated pathogenically and converted into the non-pathogenic bacillus coli. In a word, Arloing, Roux, and Rodet, and as well others, consider that neither in morphological, in cultural, nor in physiological respects is there any well-marked difference between the bacillus coli and the bacillus of typhoid fever.

These views therefore deserve detailed consideration from the view point of my own recent study of the subject.

Morphological differences.

(1.) *As to morphology.*—There can be no doubt about the similarity between the typhoid fever bacillus and bacillus coli, whether these are examined in the fresh state or as dried and stained coverglass specimens; but it is nevertheless possible to recognise even under these conditions certain marked differences. When examining a number of specimens of bacillus coli, obtained from the contents of the healthy human intestine, and grown on gelatine (Fig. 1, Plate I.), on agar, or in broth, in contrast with specimens of the typhoid fever bacillus, derived directly from the tissues of enteric fever, and taken from similar cultures of like age, one can have no doubt about the fact that by far the great majority of samples of bacillus coli are extremely short rods,—comparatively speaking few individuals are cylindrical or even thread-like; whereas the majority of samples of the typhoid fever bacillus are distinctly cylindrical, the long forms being far more numerous than in the case of bacillus coli. This is very striking when impression preparations are made of early colonies of the two species growing in gelatine plates. The colonies of the typhoid fever bacillus are made up of undoubtedly longer bacilli than those of bacillus coli; and although occasionally in a colony of this latter the individual bacilli are exceptionally long, they are, nevertheless, shorter than the bacilli in the average colonies of the typhoid fever bacillus.

* Journal de l'Anatomie, Jan. 1884.

In figure 2, Plate I., an impression is shown of the margin of a colony of bacillus coli. Here the bacilli are exceptionally long, whereas figures 20 and 21, Plate VII., represent an impression of an average colony of the typhoid fever bacillus. Comparing the two figures, it is obvious that the bacilli of the latter are longer than those of the former. This fact comes out very strikingly if, after injection of a large amount of culture in each instance into the peritoneal cavity of the guinea-pig, the two species, as found in the peritoneal fluid, are compared as to the average length of the individual bacilli. Thus, making coverglass specimens of these peritoneal fluids in the usual way, by drying a thin film of them and staining with any dye, it will be seen that the typhoid peritoneal fluid contains conspicuously longer bacilli than the coli peritoneal fluid (*see* figs 30 and 32, Plates X. and XI. Another point of difference between the bacilli of the two species in these specimens of the peritoneal fluid is this: If the coverglass specimens are well stained in methylblue aniline water and then well washed before mounting, it will be noticed that in samples of the typhoid fever bacilli, each, or most, of the bacilli show a marked differentiation between a middle clear part and deeply stained terminal portion; whereas this appearance is not noticeable in the bacillus coli prepared in exactly the same manner. The same differentiation can be made out in samples of the typhoid fever bacillus from the mesenteric glands, from the spleen, and from artificial cultivations; but in the case of bacillus coli obtained direct from the bowel or from a culture, this appearance is either to be made out in few examples only or it is absent altogether. Staining with gentian violet or methylblue (the latter preferable) is in this respect reliable; carbol fuchsin does not answer.

When fresh samples from a culture of bacillus coli are compared with fresh samples from a culture of the typhoid fever bacillus, it will be found that the mobility of the organisms from the latter is undoubtedly more pronounced than that of those from the former; that is to say a great many more individuals in the typhoid samples show active mobility than in the case of the coli samples, and the mobility is brisker in the former than in the latter. These facts are quite in harmony with the observations of Luksch,* who found that the bacillus coli possesses fewer flagella (one or two) than the bacillus of typhoid fever, which is notoriously (Löffler and others) provided with a great number of flagella.

Cultural peculiarities.

(2.) *As to cultural and other differential characters.*—It must be conceded that the appearances of the two organisms growing in agar plate cultivations, and in agar stab and streak cultures, are very similar, although it must likewise be mentioned that the rate of growth of bacillus coli in gelatine plates, and in stab and streak cultures in gelatine, is *markedly more rapid* than that of the typhoid fever bacillus. There can be no doubt about this point. All one has to do is to make the cultivation under exactly the same conditions. Cultivations on potato are not reliable. For though in all cases the typhoid fever bacillus when grown on pieces of steamed potato forms a transparent limited film on the surface, the bacillus coli occasionally produces the same kind of appearances; in the majority of instances, however, the growth on potato of bacillus coli is more copious, thicker, and slightly tinted yellow.

A conspicuous difference is at once noticed if cultivations are made of both the bacillus coli and the typhoid fever bacillus in the depth of gelatine. The best manner of showing the difference is to make "shake cultures." For this purpose gelatine contained in a test tube is inocu-

* Centralb. f. Bakt. und Parasit., XII., No. 13, p. 430.

lated with a trace of the bacillus (bacillus coli or typhoid bacillus as the case may be), is next melted in warm water, shaken, and by placing the tube in cold water is then set. On incubating this *shake* culture for a couple of days or so at 20° C., it will be noticed that each colony of bacillus coli is associated with a gas bubble, but that none are present in the shake culture of the typhoid fever bacillus; it remains quite free of them. Shake cultures of bacillus coli, in which the number of colonies is great, present a very striking appearance, inasmuch as in the depth the gelatine is densely crowded with small gas bubbles. I have never seen any gas bubbles in shake cultures of the typhoid fever bacillus, and if in any case—as for instance where the source of the bacillus is uncertain—there is doubt whether one is dealing with the bacillus coli or the bacillus of typhoid fever, a gelatine shake culture of the organism in question does not show the gas bubbles, I should be certainly prepared to maintain that the bacillus is that of typhoid fever; whereas if the gelatine shake culture shows the gas bubbles, I should certainly say it is not the typhoid but the coli bacillus. The same decided difference is noticed in agar cultures when the inoculation is made into the depth; it does not matter whether it is ordinary nutrient agar or glycerine agar.

Not less conspicuous is the difference if the two organisms are tested by milk culture. When milk (best skim milk) samples are inoculated, some with bacillus coli, some with the bacillus of typhoid fever, and are then incubated at 35–37° C. for a couple of days, the difference between the two organisms becomes very marked. The milk in which the typhoid fever bacillus is growing *remains invariably fluid* and to all appearances unaltered, whereas the milk in which the bacillus coli is growing *invariably becomes coagulated.* This result occurs with great constancy; so much so that I do not hesitate to affirm that if skim milk inoculated with a bacillus becomes curdled after incubation for two days or more, it may be safely concluded that the bacillus in question was not derived from the tissues of typhoid fever. But though milk inoculated with the typhoid fever bacillus does not become coagulated, this bacillus nevertheless grows and multiplies in the uncurdled milk to a great extent; as can be easily shown by making a subculture with a trace of material from such a milk culture. Thus, a plate cultivation made with such a trace develops an abundance of colonies of the typhoid fever bacillus.

And reaction to chemical test.

There exists one further definite and easily demonstrated difference between these two organisms. This refers to the Indol-reaction. Broth cultures of the typhoid fever bacillus never give the Indol-reaction, whereas on the other hand broth cultures of the bacillus coli always give a striking Indol-reaction. In order to demonstrate this the following plan may be followed. Let separate samples of faintly alkaline beef broth be inoculated, the one with the typhoid fever bacillus, the other with bacillus coli, and then incubated at 35–37° C. for three, four, or more days.* Next add slowly and gradually a little nitric acid to each broth culture, and the coli cultures will as a result show a pronounced orange red to a pink red colour; the typhoid bacillus cultures meanwhile remaining without any colouration, Indol being absent in them.

There are additional tests, as for instance the sugar test† (bacillus coli ferments sugar, the bacillus of typhoid fever does not); and the acid test,‡ namely, gelatine mixed with litmus solution and then inoculated

* The reaction is best pronounced after 5–7 days, though it is already demonstrable after three or four days

† Chantemesse and Vidal, Dr. Theobald Smith and others.

‡ Wurtz, Soc. d. Biolog., December 1891.

with the bacillus. In such a culture medium bacillus coli, as growth takes place, reddens the litmus; but the typhoid fever bacillus does this only very slowly, and according to my experience not so constantly and uniformly. The other tests that I have described are therefore to be preferred.

hysiological
fects.

It remains to be noted that Roux and Rodet in their contention as to the identity of these organisms lay stress on the fact that cultures of bacillus coli and cultures of the bacillus of typhoid injected intra-peritoneally into the guinea-pig, alike produce acute peritonitis and death. But as we shall see from another report in this volume on Anti-Cholera Inoculation, acute peritonitis and death of guinea-pigs result from intra-peritoneal injection not only of the bacillus coli and the bacillus of typhoid fever, but also from injection into this cavity of a number of other widely different species, *e.g.*, the cholera bacillus, the spirillum of Finkler, the bacillus prodigiosus, and the proteus vulgaris. And not only the intra-peritoneal but also the subcutaneous injection of guinea-pigs with sufficiently large doses of bacillus coli, bacillus of typhoid fever, or any of the other species above mentioned, is followed by identical symptoms, both local and general. There is not therefore any justification for the inference from the identical action on the guinea-pig of cultures of the bacillus coli and of cultures of the typhoid bacillus, that these two organisms are one and the same species. It might as well be contended that the bacillus prodigiosus is the same species as the vibrio of Finkler, because cultures of both act in exactly the same manner on the guinea-pig.

ummary.

To sum up at this stage: Evidence has been adduced showing that while bacillus coli from the contents of the healthy human intestine, and the typhoid bacillus from the tissues of enteric fever have certain points in common,* they exhibit other well-defined differences, maintained during repeated subculture both in morphological and in cultural respects. The bacillus coli is shorter, less actively mobile, produces gas bubbles in shake culture, curdles milk, and gives the Indol-reaction. The typhoid bacillus on the other hand is longer, more pronouncedly mobile, does not form gas bubbles in shake culture, does not curdle milk, and does not give Indol-reaction. Differences† of the above sort between one and another organism are usually regarded as sufficiently profound to justify their classification as separate species.

I now proceed to give a detailed account of the observations which I have made with regard to the occurrence and distribution of the typhoid bacillus in cases of enteric fever. All these cases were patients in the wards of St. Bartholomew's Hospital, and were regarded there as typical cases of enteric fever.

I. Examination of the Blood of the Living Patient.

he blood of
nteric fever.

Case No. 1.—S. P. did not feel well October 18th; developed definite symptoms of typhoid fever on October 21st; admitted to hospital October 29th. Blood taken on November 2nd, November 5th, and November 7th. Result negative both as to coverglass specimens and cultures.

Case No. 2.—A. F. developed definite symptoms of typhoid fever October 20th; admitted to hospital October 30th. Typical typhoid fever. Blood taken November 2nd and November 4th. Result negative.

* As a matter of fact they possess them in common with several other species belonging to the same group of mobile, non-sporing, non-liquefying bacilli.

† See also Tavel, Sémaine Méd., N. S., 1892.

Case No. 3.—C. T. had been ailing one month; got worse October 18th; admitted to hospital October 31st. Typical typhoid fever. Blood taken November 2nd and November 3rd. Result negative.

Case No. 4.—G. H. was taken ill suddenly October 22nd; admitted to hospital October 29th. Typical typhoid fever. Blood taken November 3rd and November 6th. Result negative.

Case No. 5.—F. S. had been unwell since October 22nd; admitted to hospital October 28th. Typical typhoid fever. Blood taken November 7th and 9th. Result negative.

Case No. 6.—J. R. was unwell and feverish November 9th; admitted to hospital November 13th. Typical typhoid fever. Blood taken on November 15th. Result negative.

Case No. 7.—C. C. was taken ill October 30th; admitted to hospital November 3rd. Typical typhoid fever. Blood was taken on November 13th and 15th. Result negative.

Case No. 8.—D. C. was taken ill November 2nd; admitted to hospital November 5th. Typical typhoid fever. Blood was taken on November 15th and 18th. Result negative.

Case No. 9.—R. B. was taken ill November 6th; admitted to hospital November 18th. Typical typhoid fever. Blood was taken on November 23rd and 27th. Result negative.

Case No. 10.—W. L. was taken ill November 8th; admitted to hospital November 17th. Typical typhoid fever. Blood was taken on November 23rd. Result negative.

Method of examination:

The examination of the blood was always carried out in the following manner: The middle finger having been thoroughly scrubbed with soap and water, was next thoroughly washed in strong carbolic solution, and, having been dried with sterile cotton wool, a piece of tape was wound round the base of the last phalanx, so as to produce a venous congestion of this phalanx. Then a prick having been made by means of a sterilised needle into the end of the last phalanx, a freshly drawn-out glass capillary pipette was held against the prick, so that blood issuing from the prick on the withdrawal of the needle must needs be immediately received into the pipette, which was then at once sealed, and reserved for culture experiments. Coverglass specimens (generally six) were meanwhile made with the remainder of the blood oozing from the prick.

by coverglass specimens;

These coverglass specimens were dried and stained in the usual dyes, *i.e.*, they were rapidly heated in the dye and at once removed therefrom, or they were left therein at ordinary temperature for from six to twenty-four hours. The dyes employed were fuchsin, gentian violet, methylblue, or a mixture of methylblue and eosin. In no case was there found in the blood anything of the nature of bacteria, except in Case 1, where in one coverglass specimen a few cocci and bacilli could be recognised, chiefly in connexion with epidermic scales which were also present in the blood sample. That these cocci did not really belong to the blood proper, but were added to it along with superficial epidermic scales, was indicated by their being present only in this one specimen in which the epidermic scales occurred, as well as by the fact that in none of the culture tubes inoculated from the blood contained in the same capillary pipette did a single coccus colony make its appearance.

and by culture.

Cultivations of the blood were made in each case, and in the following manner: From the capillary pipette, the sealed ends having been broken with sterile forceps, several drops were discharged on the slanting surface of a sterile gelatine in a culture tube. From this stock tube inoculations were then made, by the platinum loop, into other gelatine

and into agar tubes, an appreciable amount of blood being introduced into each tube. In each case cultivations were made: (*a*) into ordinary nutrient gelatine, by streak, stab, and shake culture; (*b*) into ordinary nutrient agar, by streak, stab, and shake culture; (*c*) into glycerine agar, by streak, stab, and shake culture; and (*d*) into grape sugar gelatine, by streak, stab, and shake culture.

Some of the stab and shake cultures were then sealed anaerobically, others being left in the ordinary way in contact with air. In no single instance was there any growth obtained in any tube, not even a contamination. This speaks extremely well for the scarcity of the microbes in the air of the hospital wards, as well as for the trustworthiness of the method adopted.

These negative results are then in complete harmony with those of Gaffky and others, according to whom no recognisable bacterial forms can be demonstrated, either by coverglass specimens or by culture, in the blood of the living typhoid-fever patient. I have also examined the blood in the fresh state on the warm stage, but have not noticed anything that could be identified as being foreign to the blood.

It ought to be added here that the examination of the blood was made in all cases except one, not earlier than the 12th and not later than the 21st day after commencement of the fever attack. In the exceptional case (Case 6), the examination was made on the seventh day. When blood was taken therefore, the fever patients were as a rule in the second or third week of their illness, *i.e.*, the disease was well established and typical in all its principal characters: so that if in typhoid fever the blood contains any bacterial forms demonstrable by our present methods, they should surely have been brought to light in some at least of the above cases.

II. Examination of the tissues after death.

The dead tissues in enteric fever.

Case No. 11.—Death from perforation of the intestine during an attack of enteric fever which had lasted 14 days. On post-mortem examination there was sanguineous fluid in the peritoneal cavity. The mesenteric glands and the spleen had the typical aspect of these organs at the end of two weeks of typhoid fever; they were swollen, congested, and juicy, but without necrotic foci anywhere. Coverglass specimens and cultivations were made of the heart's blood, and of the juice of the mesenteric glands and spleen. In addition bits of the mesenteric glands and spleen were placed in hardening fluids in order to be cut into sections for microscopial examination.

(*a.*) *The blood.*—Coverglass specimens made of the heart's blood showed a fair number of streptococci (Fig. 5, Plate II.), and cultivations of this blood yielded abundance of colonies of the streptococcus (fig. 6) without admixture of other organisms (Figs. 3 and 4, Plates I. and II.). These cultivations were used for inoculation into the ear of two rabbits. One of them developed typical erysipelas, with the characteristic streptococci of Fehleisen (as shown by coverglass specimens and by cultivation—Figs. 7A and 7B, Plate III.) in the fluid of the œdematous ear; the other, though it did not develop erysipelas, died after two days. The heart's blood and the viscera of this last-mentioned animal contained great numbers of the streptococcus of Fehleisen, as was proved by coverglass specimens, by cultivation (Fig. 8, Plate III.), and by injection into the ear of another rabbit.

(*b.*) *Mesenteric glands and spleen.*—Coverglass specimens of the juice of the mesenteric glands and of the spleen of Case No. 11, revealed typical typhoid fever bacilli (Fig. 15, Plate V.) in fair number, and as

well here and there a short chain of streptococcus. In the specimens from the mesenteric glands the streptococci were fairly abundant, in those of the spleen rather scarce.

Cultivations made with the juice of the mesenteric gland and of the spleen of Case No. 11 yielded great abundance of colonies of the typhoid fever bacillus; indeed, their number in these cultures far exceeded that which seemed indicated as a result of examination of the cover-glass specimens. In making these cultures, a very minute particle of material was rubbed over the slanting surface of the medium (nutrient gelatine, or agar) which, after incubation for two to four days, presented a surface crowded with colonies of the typhoid fever bacillus (Figs. 9, 10, and 11, Plate IV.). With regard to streptococci, a remarkable fact came out in these cultures. As already mentioned, the number of streptococci in the coverglass specimens was fairly abundant, particularly in those of juice from the mesenteric glands; nevertheless in culture the number of colonies of streptococci was extremely limited. Thus, I find in my notes that of tubes inoculated with material from the mesenteric glands, three gelatine and three agar tubes containing numerous colonies of the typhoid fever bacillus, contained colonies of no other organism; one gelatine tube contained, amongst many typhoid bacillus colonies, three colonies of the streptococcus; and one agar tube contained, amongst many typhoid bacillus colonies, only one colony of the streptococcus. In the cultivations from the spleen juice, out of eight tubes seven contained, in pure culture, numerous colonies of the typhoid fever bacillus, and one, an agar tube, only contained one streptococcus colony amongst a number of colonies of the typhoid fever bacillus.

(*d.*) *The hardened tissues.*—Sections made from the hardened mesenteric glands and spleen showed the typhoid fever bacilli in streaks and masses (Fig. 16, Plate VI.) in what corresponded to lymph channels; but, as the coverglass specimens might have led one to expect, the number of these masses of the bacilli was very limited. In a particular section of about half an inch square only one or two, or at most three such masses were found, and only in a few sections were they so numerous as this. On the other hand, the number of small and large masses of streptococci scattered amongst the lymph cells or contained in the lymph channels of the mesenteric glands, was astonishingly large. Fig. 17, Plate VI. gives an idea of this condition. In every section the spots pervaded by streptococci easily attract attention.

Facts as to Case 11.

From this detailed description it will be seen that while the mesenteric glands and the spleen, as tested by cultivation, contained an abundance of living typhoid fever bacilli and extremely few living streptococci; the heart's blood contained living streptococci only and no typhoid fever bacilli. Another point worthy of note is that though there was great abundance of streptococci in the tissue of the mesenteric glands, as shown in the sections of the hardened material, the culture test proved that the very great majority of these streptococci must have been dead, since extremely few colonies (only four colonies in eight tubes) came up on culture. While, then, the typhoid fever bacillus does not live in the blood of enteric-fever patients, but thrives well in their mesenteric glands and spleens, the streptococcus lives well in their blood, but does not flourish in their mesenteric glands or their spleens. That, however, the streptococcus did, in patient No. 11, produce some important change is most likely; the perforation of the bowel which caused death may indeed have been the result of its growth and activity in the ulcers of the intestine. At any rate the sanguineous fluid in the peritoneal cavity of this case contained numerous streptococci; the wall of the

intestine unfortunately was not examined. Various observers have described streptococci as microbes occurring in typhoid fever in superaddition to the typhoid fever bacillus, amongst whom Dr .Vincent* is the most recent writer on this subject. The view of several French observers, however, as to perforation of the bowel in typhoid fever being caused by the activities of bacillus coli, is not borne out by the above case, No. 11; and I shall presently have to mention another case of perforation of the bowel in which likewise streptococcus was present in the blood.

Case No. 12.—Taken ill December 20th; admitted to hospital December 22nd. Typical case of typhoid fever. Died January 3rd, from hæmorrhage and bronchitis. Duration of illness 14 days. On post-mortem examination the mesenteric glands were found much swollen and very juicy; no necrotic spots. The spleen was greatly enlarged, it weighed 12 ounces; no necrotic spots. The heart's blood, and the juice of the mesenteric glands and of the spleen, were examined in coverglass specimens and by cultivation.

(*a.*) *The Heart's Blood.*—In coverglass specimens this contained a few streptococci, and by cultivation of it the following results were obtained:—Two agar tubes showed a pure cultivation in each instance of streptococcus in numerous colonies. Four gelatine tubes also contained each numerous colonies of the same streptococcus; but while one of these four tubes contained no other colonies except those of the streptococcus, the other three did: viz., one of them contained nine additional colonies of a second microbe which turned out to be the typhoid fever bacillus, while the second and third tubes each contained one colony of the typhoid bacillus. The streptococcus of the culture tubes was tested by experiment on the rabbit's ear, as well as by sub-culture, and was proved not to be the streptococcus of erysipelas of Fehleisen: it had no effect when injected into the ear of two rabbits, and in culture it grew more like the streptococcus pyogenes. The bacillus growth that came up in the three gelatine tubes above mentioned was carefully examined by sub-cultures, and the organism in question stood all the tests, both morphological and cultural, already defined, that characterise the typhoid fever bacillus.

(*b.*) *The juice of the mesenteric glands,* both in coverglass specimens and in cultures, yielded abundance of colonies of the typhoid fever bacillus; but the culture tubes contained besides colonies of the streptococcus.

(*c.*) *The juice of the spleen* yielded the same results, viz., abundance of colonies of the typhoid fever bacillus, and also colonies of the streptococcus.

Facts as to Case 12.

These observations are accordingly in contrast with those made on Case No 11. In Case No. 12 the typhoid fever bacillus was found co-existing in the heart's blood with a streptococcus, although the latter greatly preponderated. And the same co-existence of the two species was found in the mesenteric glands and in the spleen, though in both these tissues the typhoid fever bacillus preponderated over the streptococcus. The difference between the two cases Nos. 11 and 12, may be due on the one hand to inability of the typhoid fever bacillus to subsist along with the streptococcus of erysipelas, and on the other hand to ability of the typhoid fever bacillus to contend to some extent with the streptococcus pyogenes. As to this, each of these species has, no doubt, after the

* Annales de l'Institut Pasteur, 1892, p. 28.

manner of many pathogenic bacteria, its particular favourable and unfavourable breeding grounds; the streptococci, for instance, preferring the blood, while the bacillus of typhoid fever dislikes the blood but prefers the mesenteric glands and the spleen; and in view of the above observations it may even be thought that the presence of the streptococcus pyogenes in the circulation encouraged the typhoid fever bacillus to thrive in the blood, and that, on the other hand, the streptococcus of erysipelas was unable to live in the tissues in which the typhoid fever bacillus was thriving. The fact that some species of streptococcus (in Case No. 12 the streptococcus pyogenes) can thrive well alongside the typhoid fever bacillus, the one organism so to speak, assisting the other, is indeed mentioned by Dr. Vincent as a consideration that may be reasonably entertained.

Facts as to Case 13.

Case No. 13.—Death in this case was due to relapse of typhoid fever, the patient having been attacked six weeks previously, namely, on February 25th. On post-mortem examination the mesenteric glands and the spleen were found much enlarged. The heart's blood, and the juice of the mesenteric glands and of the spleen were examined by culture, with results as follow:—

(*a.*) *In cultures of the heart's blood* there appeared a considerable number of colonies which proved colonies of the typhoid fever bacillus. There were also present a small number of colonies of a liquefying staphylococcus (albus), and a few colonies of a non-liquefying staphylococcus.

(*b.*) *From the juice of the mesenteric glands* abundance of colonies of the typhoid fever bacillus (in pure culture) were obtained.

(*c.*) *From the spleen* also there was obtained great abundance of colonies of the typhoid fever bacillus (in pure culture), the number of colonies in the spleen cultures being greater than in the mesenteric gland cultures.

This case is of interest, for the reason that the heart's blood contained the typhoid fever bacillus in greater abundance than any case yet examined. The spleen and the lymphatic glands also yielded the typhoid bacillus, in pure culture.

Case 14.

Case No. 14.—Typical typhoid fever; death from hæmorrhage on the 17th day of the illness. In this case the heart's blood proved free of organisms, all cultures therefrom remaining sterile; but the juice of the mesenteric glands and of the spleen contained the typhoid fever bacillus in pure culture, each tube yielding abundance of colonies,—the spleen more numerously than the mesenteric glands.

and Case 15.

Case No. 15.—This case was one of typical typhoid fever, that died suddenly during the ninth week from perforation of the bowel. Cultures (on slanting gelatine) were made from the juices of the mesenteric glands and spleen. The result was somewhat anomalous. Each culture made from the juice of the mesenteric glands yielded colonies: one tube yielded one colony that might from its appearance be either typhoid fever bacillus or bacillus coli; a second tube showed several colonies of cocci, some liquefying, some non-liquefying; a third tube had three liquefying colonies of a coccus; and a fourth tube remained sterile. Of the cultures made from the spleen, one tube had one colony that might be, as before, either the typhoid fever bacillus or bacillus coli, and one colony of a liquefying coccus; a second tube showed two non-liquefying whitish grey colonies, which from their general aspect could not be classed,—they certainly did not resemble either bacillus coli or the typhoid fever bacillus; a third tube contained

two non-liquefying yellow colonies (bacillus luteus); and a fourth tube remained sterile.

The colonies—one from the mesenteric gland, one from the spleen—which are mentioned as somewhat resembling both the typhoid fever bacillus and bacillus coli, were then most carefully studied by subcultures, and by this means it was found that both these colonies were of the same nature. They differed, however, from the typhoid fever bacillus more than from bacillus coli; the organism in question was shorter than the typhoid fever bacillus and about the same length as bacillus coli; it formed gas bubbles like bacillus coli, and, unlike therefore the typhoid fever bacillus; it grew much faster than the typhoid fever bacillus, and about as fast as bacillus coli; it failed, like the typhoid fever bacillus, to coagulate milk, and differed therefore in this respect from bacillus coli; and finally it did give Indol-reaction, in which it was unlike the typhoid fever bacillus, but resembled bacillus coli. On the whole the organism seemed most like bacillus coli, and might have been declared identical with that organism but for its inability to curdle milk. In this sense it resembled the typhoid fever bacillus; in all other respects it certainly differed from that organism.

It is then justifiable to declare that in this enteric-fever case of nearly nine weeks' standing no typhoid fever bacillus was demonstrable in the mesenteric glands or in the spleen, and in this respect the experience agrees with that of other observers who failed to find the typhoid bacillus in the later stages of this disease. Whether or not in this case the perforation of the bowel was due to the processes of the quasi-coli bacillus is very doubtful, seeing how few colonies of this organism were present in the spleen or mesenteric glands.

Summary of the bacteriology of the tissues in enteric fever.

In view of the above series of observations, the occurrence of the typhoid fever bacillus in large numbers in the mesenteric glands and the spleen, during the second or third week of the disease, becomes an established fact. It is present indeed in these tissues in an abundance which is very striking, a very large number of colonies of this bacillus being obtainable by inoculating the nutrient medium with only a minute particle in each instance of the tissues in question. Moreover, excepting those cases in which in addition a streptococcus was present in the blood, the typhoid fever bacillus was often present in the tissues of the enteric-fever patients in pure culture. These facts seem very strongly to point to the conclusion that this bacillus stands in intimate relation to the disease itself; as was first indicated by Eberth, was next further insisted on by Gaffky, and is now accepted by most bacteriologists. And if regard is had to the circumstance that the presence in the mesenteric glands and spleen of an abundance of this one particular species of bacillus (or indeed of any other species), is not found in any other condition except enteric fever, the inference that the typhoid fever bacillus is in effect the *vera causa* of that particular disease obtains all but complete justification. It might, of course, be urged (and I myself shared formerly in that opinion) that the disorganisation of the intestinal wall during typhoid fever being considerable, immigration into the diseased intestinal wall (the inflamed and ulcerated Peyer's patches), and thence into the mesenteric glands and spleen, of an organism that is admittedly present in the contents of the diseased intestine, would be favoured; and that its presence in these tissues should be considered a result therefore rather than the cause of the fever But this view is, I think, not tenable for the following reasons:—

(*a.*) The presence of the typhoid fever bacillus in the mesenteric glands and in the spleen in pure cultivation is demonstrable as early as

during the second week of the fever; that is to say, before any considerable disorganisation of the Peyer's patches has taken place.

(*b.*) In the later stages of the fever, when the ulceration in the intestine is at its height, the number of the typhoid fever bacilli in the mesenteric glands and the spleen, according to all accounts, decreases, and gradually the bacillus altogether disappears.

(*c.*) Few of the other bacteria present during the fever in the intestinal contents find their way into, or are abundantly present in, in living condition, the mesenteric glands or the spleen.

With reference to the latter consideration, various French observers, amongst them Rodet and Roux, have found the bacillus coli in some cases of typhoid fever present in the intestinal contents, almost in pure culture. Nevertheless the mesenteric glands and the spleen in such cases do not contain the bacillus coli, but the typhoid fever bacillus. The intestine (the ileum) of man, be it noted, is never without the bacillus coli,* and there is no difficulty whatever in obtaining it in a number of colonies from any intestinal contents; but the bacillus obtained from the mesenteric glands and from the spleen, during the second and third week of the disease, is invariably the typhoid fever bacillus, and not the bacillus coli; though during the second and third week of a case of enteric fever, both species can be identified without difficulty in the contents of the ileum or in the typhoid stool.

There is then the strongest presumption, short of actual proof, that this particular organism called the typhoid bacillus, which differs essentially from the bacillus coli, stands in an intimate relation to the disease enteric fever.

Physiological considerations.

In bringing this paper to a conclusion, I revert to the physiological effect on rodents of the bacillus of typhoid fever, with a view to indicating the true significance of the results that have been obtained in this respect.

Observers with but few exceptions, after attempting to convey, either by typhoid stools, by typhoid organs, or by cultivations therefrom, typhoid fever to the lower animals, have arrived at the conclusion that these animals are not susceptible to this disease. Frænkel and Simmons, however, have maintained that by injecting large quantities (1–2 c.c. and more of broth culture) of the typhoid fever bacillus into rabbits, they have produced in them an acute fatal disease in which hyperæmia and swelling of the Peyer's glands were conspicuous features. So too numerous other observers (as, for instance, Wyssokowicz, Beumer and Peiper), experimenting on various rodents (rabbits, guinea-pigs, and mice), have by injection of large doses of broth culture of this bacillus produced in these animals acute disease and death. This disease they justly consider as due to a form of septicæmia, in which conclusion almost all experimenters will agree. For, by injecting subcutaneously into rodents large doses of very different micro-organisms, acute disease and death—in from one to three days—are produced; the post-mortem experiences (very similar in all cases) being those that merely indicate septicæmic poisoning:—as for instance, congestion of all viscera including the small intestine, occasionally hæmorrhages in the serous membranes, the spleen slightly or distinctly enlarged, the

* See Dr. Cautley's report.

organism injected being moreover present in the heart's blood and in all organs. Occasionally in these circumstances, but not invariably, Peyer's glands are prominent and injected. The main condition to be fulfilled for obtaining this result is, be it observed, that large doses have to be used. In another report in this volume will be found account of my experiments with the vibrio of Finkler, the bacillus prodigiosus, and the bacillus coli; and it is there shown that infections identical with those obtained with the typhoid fever bacillus are produced be subcutaneous injection of these microbes into the guinea-pig. In like manner, the results obtained by the intraperitoneal injection into guinea-pigs of large doses of the bacillus of typhoid fever are there described, from which it will be seen that identical results are obtained by intraperitoneal injection of the vibrio of cholera, the vibrio of Finkler, the bacillus prodigiosus, and the bacillus coli: So that the contention of Roux and Rodet, respecting identity of bacillus coli and bacillus of typhoid fever, merely because they act in the same way when injected intraperitoneally, loses its importance, the results being in no sense specific.

It is to be inferred from experiments on rodents then that no specific disease—*i.e.*, a disease that can in any way be interpreted as comparable to typhoid fever, or that can in any way be considered as due to an action peculiar to the bacillus of typhoid fever—can be produced in these animals with cultures of the typhoid fever bacillus; and that therefore these animals not being susceptible to typhoid fever, experimental proof that the typhoid fever bacillus is the real cause of enteric fever in man cannot yet be furnished.

PLATE I.

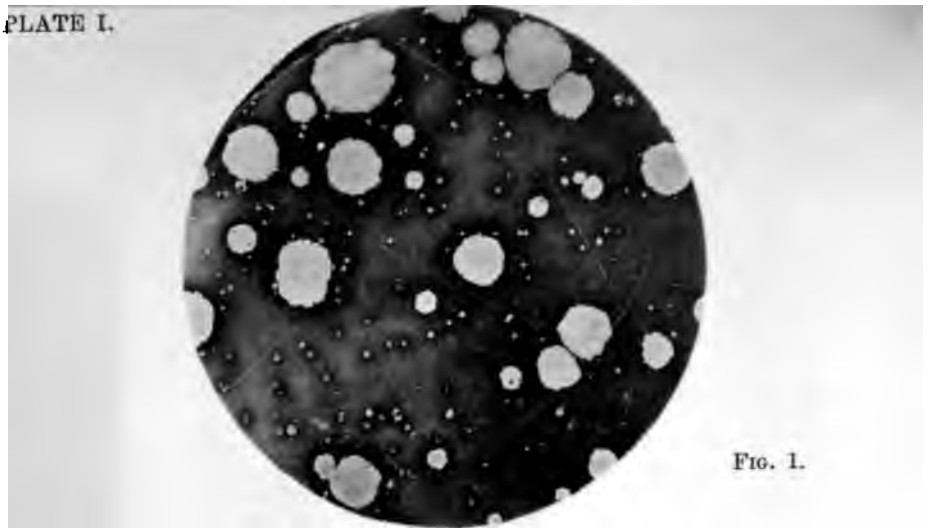

FIG. 1.

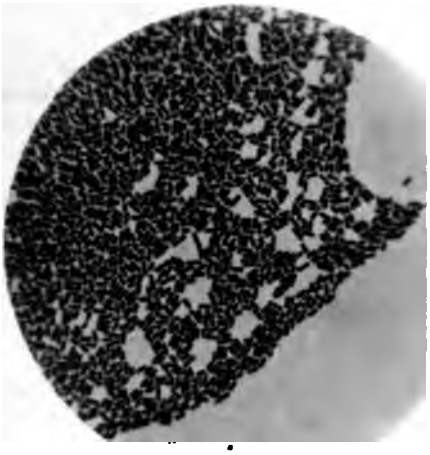

FIG. 2.

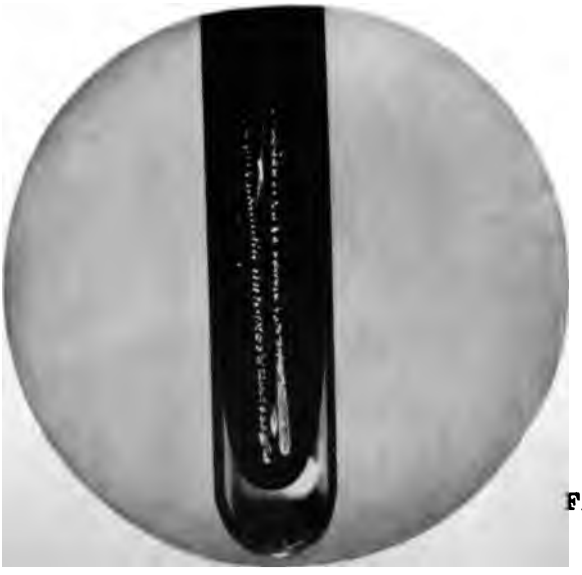

FIG. 3.

ETIOLOGY OF ENTERIC FEVER.

PLATE I.

FIG. 1.

Reproduced from a photograph* of a *gelatine-plate* culture of *bacillus coli*. The large colonies are on the *surface*, the small colonies in the *depth* of the gelatine (page 347).

[Natural size.]

FIG. 2.

Reproduced from a photograph of an "Impression Preparation" of part of a colony of *bacillus coli* (page 348).

[Magnifying power, 1,000.]

FIG. 3.

Reproduced from a photograph of a *streak culture in gelatine* of the *streptococcus of Erysipelas*, derived from the *heart's blood, Enteric Fever*, case No. 11; fatal from perforation of the bowel (page 352).

[Natural size.]

[* The reproductions of the photographs for this Volume are by the Autotype Company.] The microphotographs are by Mr. E. C. Bousfield.

ETIOLOGY OF ENTERIC FEVER.

PLATE II.

FIG. 4.

Reproduced from a photograph of a culture *on the surface of agar* of the streptococcus from the heart's blood of Enteric Fever, case No. 11 (page 352).

[Natural size.]

FIG. 5.

Reproduced from a photograph of a cover-glass specimen of the heart's blood of Enteric Fever, case No. 11. Blood discs are depicted along with a single well-defined *streptococcus* chain (page 352).

[Magnifying power, 1,000.]

FIG. 6.

Reproduced from a photograph of a cover-glass specimen of the above *streptococcus*, from the condensation fluid in the *agar tube* referred to in Fig. 4 (page 352).

[Magnifying power, 1,000.]

FIG. 4.

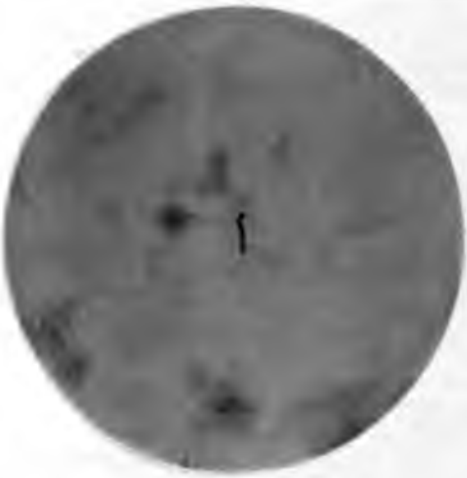

FIG. 5.

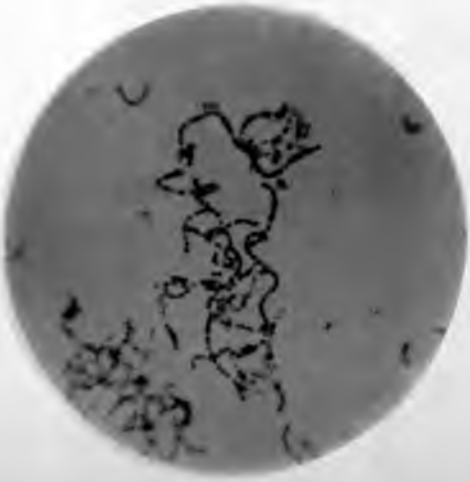

FIG. 6.

PLATE III.

FIG. 8.

FIG. 7(*a*).

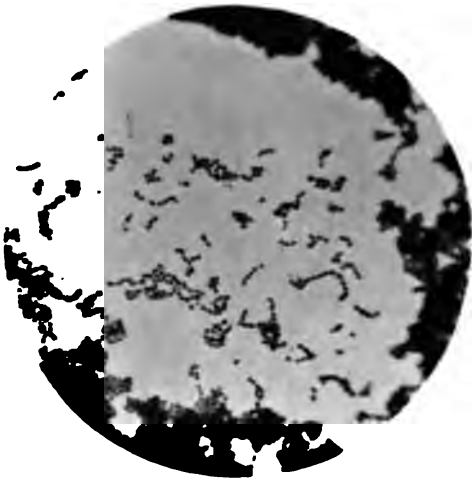

FIG. 7(*b*).

ETIOLOGY OF ENTERIC FEVER.

PLATE III.

FIG. 7(A).

Reproduced from a photograph of a culture *on agar* of the streptococcus from the heart's blood of Enteric Fever, case No. 11, after it had been removed from the erysipelatous ear of an experimental rabbit (page 352).

[Natural size.]

FIG. 7(B).

Reproduced from a photograph of a cover-glass specimen of the above *streptococcus* from the "condensation fluid" of the *agar* culture referred to under Fig. 4 (page 352).

[Magnifying power, 1,000.]

FIG. 8.

Reproduced from a photograph of a culture *on the surface of gelatine* of the *streptococcus of Erysipelas* from the heart's blood of a rabbit subcutaneously injected with the streptococcus culture referred to under Fig. 4 (page 352).

[Natural size.]

ETIOLOGY OF ENTERIC FEVER.

PLATE IV.

FIG. 9.

Reproduced from a photograph of a pure culture *on the surface of gelatine* of the "typhoid bacillus." The culture was obtained by rubbing over the surface of the gelatine a particle of a *mesenteric gland* from the body. Enteric Fever, case No. 11 (page 353).

[Natural size.]

FIG. 10.

Reproduced from a photograph of a similar culture of the "typhoid bacillus" derived in this instance from the *spleen* of Enteric Fever, case No. 11 (page 353).

[Natural size.]

FIG. 11.

A similar pure culture of "typhoid bacillus" from the *spleen* of a different case of Enteric Fever (page 353.

[Natural size.]

FIG. 12.

Reproduced from a photograph of a *streak* sub-culture on the *surface of gelatine* of the "typhoid bacillus" of Fig. 11.

[Natural size.]

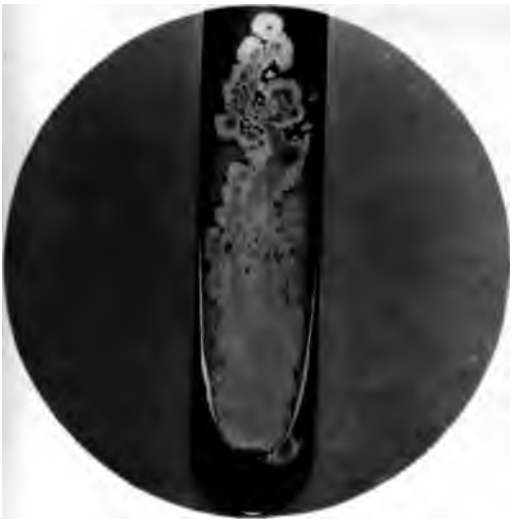

FIG. 9.

FIG. 10.

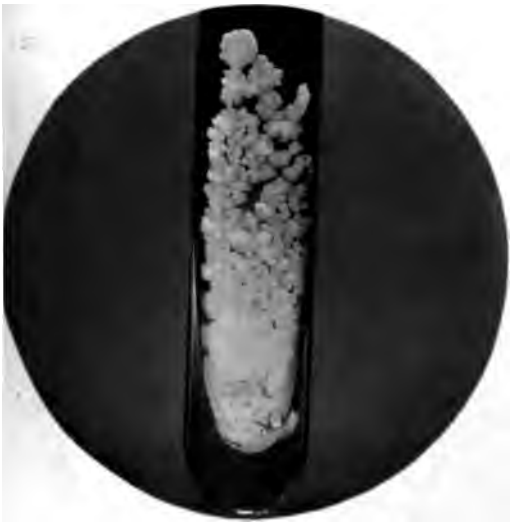

FIG. 11.

FIG. 12.

PLATE V.

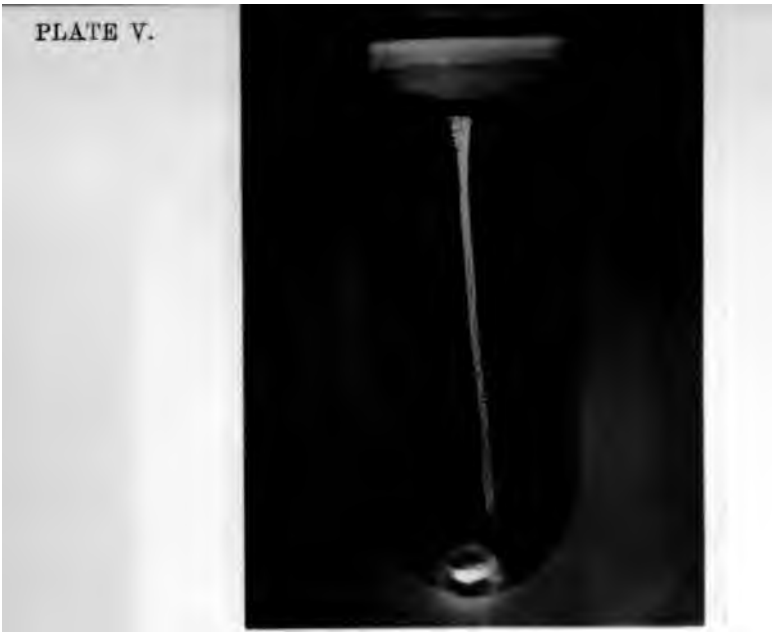

FIG. 13.

FIG. 14.

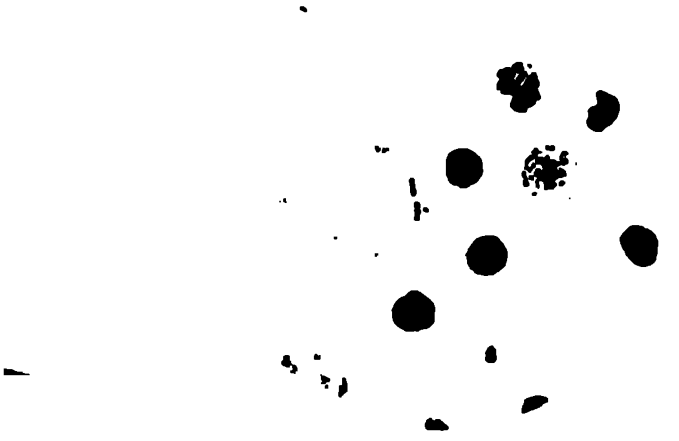

FIG. 15.

ETIOLOGY OF ENTERIC FEVER.

PLATE V.

FIG. 13.

Reproduced from a photograph of a *stab-culture* in gelatine of the "typhoid bacillus."

[Magnifying power, 2.]

FIG. 14.

Reproduced from a photograph of a cover-glass specimen of *bacillus coli*, derived from the intestinal mucus of a *mouse*.

[Magnifying power, 1,000.]

FIG. 15.

Reproduced from a photograph of a cover-glass specimen of *spleen pulp* from Enteric Fever, case No. 11. Nuclei of the spleen tissue are depicted; and as well two "typhoid bacilli," which show polar staining (page 353).

[Magnifying power, 1,000.]

ETIOLOGY OF ENTERIC FEVER.

PLATE VI.

FIG. 16.

Reproduced from a photograph of a section through the *spleen* of Enteric Fever, case No. 11. A number of "typhoid bacilli" massed together are here seen (page 353).

[Magnifying power, 1,000.]

FIG. 17.

Reproduced from a photograph of a section through a *mesenteric* gland of Enteric Fever, case No. 11. Numerous *streptococci* are here seen (page 353).

[Magnifying power, 1,000.]

FIG. 18.

Reproduced from a photograph of a cover-glass specimen of "typhoid bacilli."

[Magnifying power, 1,000.]

PLATE VI.

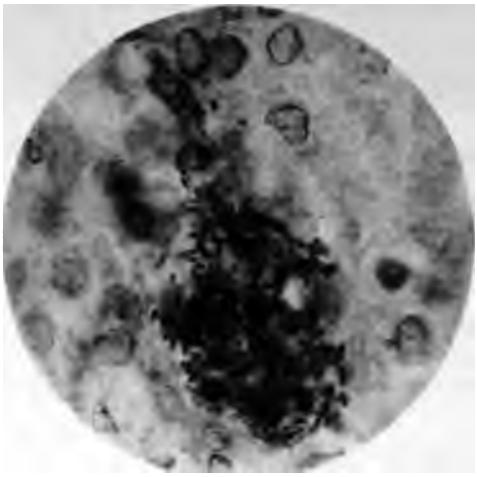

FIG. 16.

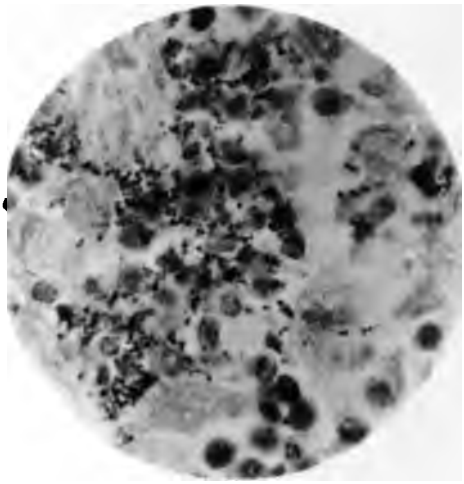

FIG. 17.

FIG. 18.

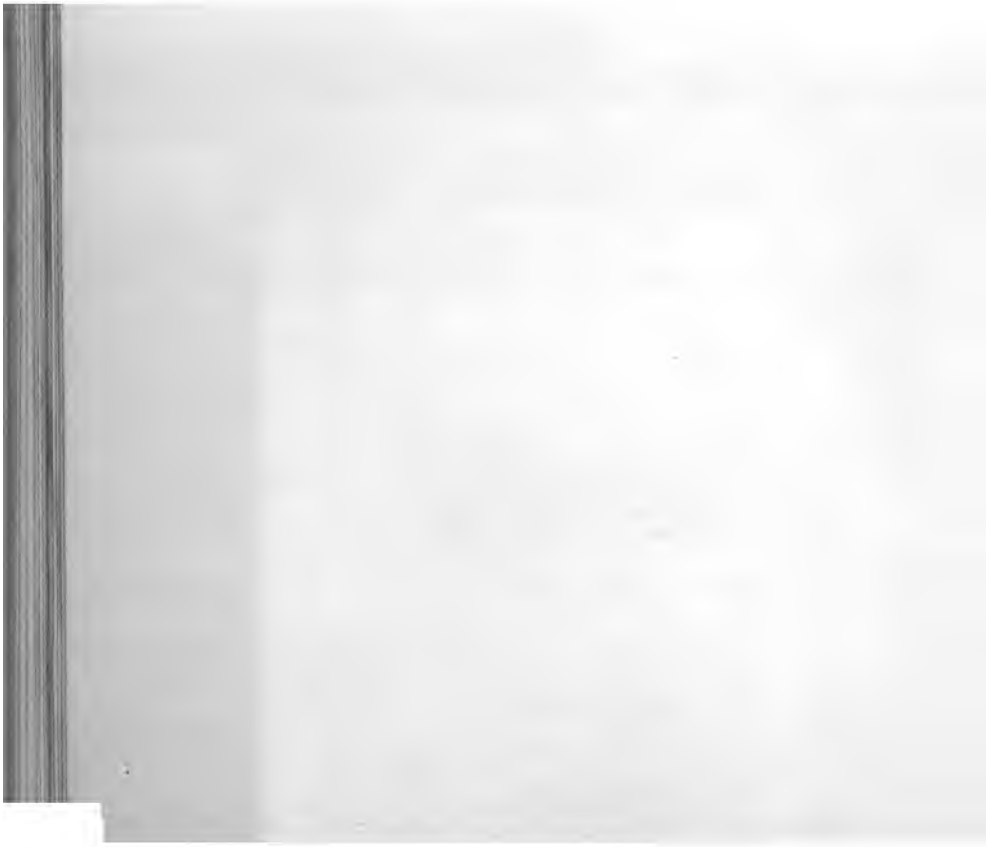

PLATE VII.

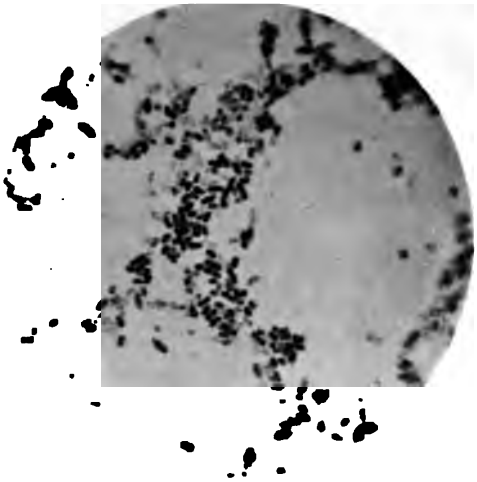

FIG. 19.

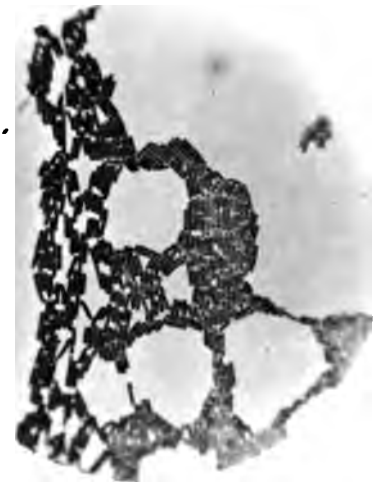

FIG. 20.

FIG. 21.

ETIOLOGY OF ENTERIC FEVER.

PLATE VII.

FIG. 19.

Reproduced from a photograph of a cover-glass specimen from an *agar* culture of the "typhoid bacillus." The culture was a week old, and contained numerous dead bacilli which are indicated by empty faintly stained sheathes.

[Magnifying power, 1,000.]

FIG. 20.

Reproduced from a photograph of an "impression preparation" of a young colony of the "typhoid bacillus" on *gelatine* (page 348).

[Magnifying power, 1,000.]

FIG. 21.

Reproduced from a photograph of a very young colony of the "typhoid bacillus" (page 348).

[Magnifying power, 1,000.]

No. 2.

On the Antagonisms of Microbes; by Dr. Klein, F.R.S.

In former reports various experiments have been described by which it was shown that while a definite antagonism is observed between certain different pathogenic microbes injected simultaneously or in sequence into the living animal, there exist other pathogenic microbes which is not exert in the living animal any such antagonism. I have during the past year continued these observations, testing, one against another, species of microbes which in their morphological and cultural characters are so far related that they belong to one and the same group; namely, the vibrio of cholera and the vibrio of Finkler; the bacillus coli and the bacillus of typhoid fever; and the pigment producing bacillus prodigiosus and staphylococcus aureus.

Protoplasmic Poisons.

While I was thus employed M. Haffkine published his first account of his anti-cholera vaccination; accordingly since the experiments which I had begun belonged to the same class as Haffkine's, I extended mine so as to cover also the ground traversed by him.

As a preliminary to the account of these experiments, it is necessary to mention that the animals used by Haffkine, and almost all those used by myself, were guinea-pigs; and that the principal experiments of Haffkine, as also many of my own, were intraperitoneal injections of the microbes per se, without admixture of the material in which they had been grown.

R. Pfeiffer's experiments.

The first experiments of this character had been made and published by R. Pfeiffer. This observer had shown (Zeitschr. f. Hygiene, vol. xi., 3), that by injection into the peritoneal cavity of the guinea-pig of large masses of the cholera vibrios, scraped off from the surface of nutrient agar on which they had grown, rapid death (in 24 hours or less) of that animal is produced; death being due to intense acute peritonitis. This result was achieved by Pfeiffer equally well whether the vibrios were injected in a living or in a dead condition.* From the fact that the bacteria alone were injected, he justly concluded that their protoplasm includes a substance which when introduced in sufficiently large doses into guinea-pigs acts thus poisonously on them. Pfeiffer further found that by injecting after the same methods, the vibrio of Finkler, or the vibrio of Metschnikoff, instead of the vibrio of cholera, the same fatal results, due to intense acute peritonitis, are produced in the guinea-pigs. But oddly enough Pfeiffer attributes the fatal peritonitis resulting from injection of the cholera vibrio, to what he calls "the primary cholera poison" lodged in the bodies of these vibrios, and attributes the fatal peritonitis caused by the vibrios of Finkler and of Metschnikoff to a "similar" poisonous substance lodged in the protoplasm of these organisms; whereas the conclusion to be drawn from his comparative experiments would seem to be that these three diffe-

* For the purpose of killing his vibrios Pfeiffer submitted them to boiling, drying, chloroform, ammonium sulphate, alcohol, or other agents.

rent species, producing as they did the same results on injection, contain the *same* poisonous principle. If Pfeiffer had shown by other experiments that the protoplasms of these three species, though each of them poisonous, nevertheless acted differently in a physiological sense, he might have spoken of their possessing "similar" poisonous principle; and he would also have been at liberty to have spoken of a primary cholera poison in the case of the cholera vibrio. But, as has been said, all his experiments showed was that these three species acted in precisely the same way; so that if there be a "primary cholera poison" lodged in the cholera vibrio, there must be a "primary cholera poison" lodged also in the vibrio of Finkler, and similarly in the vibrio of Metschnikoff. However this may be, it is clear from the numerous experiments made by Pfeiffer, that these three species, whether alive or dead, include in their substance a principle which when intraperitoneally injected into the guinea-pig produces acute fatal peritonitis. The amount injected plays however a most important part, because unless the quantity is very large, no fatal result is produced, or at any rate the fatal result is greatly delayed: small doses produce only transitory illness and the animals recover.

Haffkine's experiments.

A method similar to that of Pfeiffer was used by Haffkine. Haffkine grows the vibro of cholera on the slanting surface of nutrient agar for one or two days at 35° C. He then rubs the surface growth down into sterile beef bouillon and injects large quantities (one to two test tubes) of this mixture into the peritoneal cavity of the guinea-pig. The animals so operated on die as a rule within 24 hours, the post-mortem appearances being those of acute intense peritonitis. There is in animals so dealt with more or less copious peritoneal exudation containing the vibrios in a living state. Now, Haffkine uses this peritoneal exudation, again in considerable doses, for further intraperitoneal injection into guinea-pigs; and with the result that the animals die from the same acute intense peritonitis, the living cholera vibrios being found more or less abundantly present in the peritoneal exudation. By further transferring this exudation through a succession of twenty to thirty guinea-pigs, Haffkine establishes a very remarkable intensification of the virulence of the exudation, inasmuch as the effect produced in the later guinea-pigs of the series is much enhanced, the animals succumbing in shorter and shorter periods, the maximum intensity being reached when death takes place after 8 to 12 hours. But not only in this acceleration of the fatal issue does the exaltation of virulence show itself; this fatal result is obtained with much smaller doses in the later series than in the earlier. Moreover the increasing exaltation in virulence belongs not only to the peritoneal exudation of the gradually extending series of the animals, but to the vibrios themselves; for Haffkine finds that the maximum virulence of the exudation having been reached (as tested by the greatest rapidity of the fatal issue), cultivation of the vibrios of such exudation on agar produces crops which possess the same exalted virulence, inasmuch as of such a culture a fraction ($\frac{1}{10}$–$3\frac{1}{2}$ of the growth) acts as virulently as 10 or 30 times that amount of the original agar growth that was used to start the series. These cultures of exalted virulence, "*virus fort*," do not, however, retain their full power either for an unlimited time or for an unlimited number of subcultures. On the contrary they soon begin to lose their exalted virulence, though by a renewed transmission through one or two guinea-pigs, and by making fresh cultures on agar of the peritoneal exudation of these guinea-pigs, the "*virus fort*" can again readily be obtained.

[I do not here enter into a discussion of Haffkine's contention that the condition produced in the guinea-pig, by these intraperitoneal

injections of the cholera vibrio, is comparable to Asiatic cholera. Later on I refer to this in detail. But in passing I wish to note that the symptoms of the disease thus induced in guinea-pigs, and the post-mortem appearances observed in them, do not suggest cholera Asiatica. Moreover, as will presently be seen, the identical disease, and the same post-mortem appearances, are producible by a number of other and totally different species of bacteria.]

These experimental results obtained by Haffkine form the basis for the anti-cholera inoculations practised by him. He inoculates guinea-pigs subcutaneously with small doses of his *virus fort*, either in its purity (that is direct from a culture), or after adding phenol so as to attenuate its virulence. As a rule, in his later experiments, as described by Professor Wright and Dr. Bruce ("British Medical Journal," February 4th, 1893), Haffkine uses for a first subcutaneous inoculation of the guinea-pig (first vaccine), the *virus fort* attenuated by phenol, and afterwards inoculates it with his second vaccine, which is either the *virus fort* pure, or the same only slightly carbolised. The subcutaneous injection of the attenuated *virus fort* into the guinea-pig produces a local and general disturbance. The latter shows itself in a rise of temperature, while the former is manifested by development of a swelling which is at first (in 2–3 days) soft, then gradually diminishes in size and becomes firmer, and as a rule leads later on to a necrosis of the skin in the region of the inoculation, which ultimately completely heals. The second injection is practised a few days after the first; and thereafter, if the animal is within a further few days inoculated intraperitoneally with doses of the *virus fort* (which infallibly kills normal guinea-pigs within about 12 hours), it is found that the animal remains alive. These are in the main the principal experiments on which Haffkine bases his anti-cholera vaccination.

The experiments made by me in this direction I now proceed to describe.

I.—Intraperitoneal Injection into Guinea-pigs of the Cholera Vibrio.

Recent experiments.

Cultures of the cholera vibrio were obtained from a case of cholera that was admitted to St. Bartholomew's Hospital towards the end of August 1892. The patient had, with his daughter, recently arrived from Hamburg, and on arrival in London both had sickened with suspicious symptoms, so that the Medical Officer of Health had them transferred to the hospital. The girl showed typical symptoms of Asiatic cholera, but recovered. The father died, but his symptoms were not typical. On post-mortem examination the intestine did not show the characteristic appearances of Asiatic cholera. Nevertheless it contained fœcal matter from which Dr. Cautley succeeded in obtaining cultures of the characteristic Koch's cholera bacillus. Subcultures of this bacillus were carried on for a few generations in gelatine, and from these agar cultures were made that served for the intraperitoneal injection of guinea-pigs.

living cholera vibrios injected intraperitoneally;

Injection of living Cholera Vibrios.—A platinum loop dipped previously in a gelatine culture of the bacillus was rubbed over the slanting surface (6 centimeters by 2 centimeters) of the solidified agar, which was then placed in the incubator and kept there at a temperature of 37° C. for 48 hours. The growth covering the whole surface of the agar was now removed by means of the sterile platinum loop and rubbed down in a test tube with 5 c.c. of sterile beef

broth. This formed a turbid mixture, with many flocculi, which was poured off into a sterile watch-glass and used for the intraperitoneal injection. From $\frac{1}{5}$–$\frac{1}{2}$ of this broth mixture (*i.e.*, 1–2·5 c.c.) was found sufficient to produce fatal result. It was drawn up into a sterilised Pravaz syringe, and, the animal having been placed under chloroform-ether narcosis, the injection was performed through the anterior abdominal wall. By making the middle of the abdomen a little tight (an assistant placing one hand on the chest, the other across the groins) the injection is successfully performed without risk and without difficulty. A few hours (4–8) after the injection the animals show distinct signs of illness; they become quiet, huddle themselves up in a corner of their cages, and cease to feed; their temperature is lowered. After about 8–12 hours this condition is more pronounced; they are now unwilling to walk, and if they attempt this, are shaky and unsteady. As a rule the animals are found dead next morning, that is within 20 to 24 hours. Using $\frac{1}{2}$ or more of the scrapings from a culture tube, the result is uniformly fatal; less than $\frac{1}{2}$ but more than $\frac{1}{3}$ of a tube produces generally, though not invariably, a fatal result. Less than $\frac{1}{3}$ of the scrapings from a tube as a rule produces only a transitory illness, the animals recover after a day or two. The post-mortem examination shows the following appearances:—The *peritoneum* covering the anterior abdominal wall is greatly congested; this congestion sometimes extends into the abdominal muscles, and is then associated with hæmorrhages from the minute vessels. The *omentum* with the *serous covering* of the intestines is in most cases congested, but in some I have seen the serous coat of the small intestine rather pale; that of the stomach is, however, always intensely and conspicuously congested. The most pronounced general congestion of the peritoneum, associated with hæmorrhage, is noticed in the animals injected with Haffkine's virus fort (see below), the peritoneum of the abdominal wall and the muscle itself being of deep purple colour. The serous covering of the *liver* and the omentum are covered with greyish membranes; sometimes in a thick layer, at other times only a few flakes. The small *intestine* is either fairly contracted or it is more or less distended by muco-sanguineous contents, which only in a few instances are more or less of a fluid character. [Beyond question therefore the condition of the small intestine is by no means of a uniform character. It certainly is not of a nature to justify Mr. Hankin ("British Medical Journal," 1892), when speaking of Haffkine's results, in saying that the condition of the intestine is characteristic of Cholera Asiatica. From my own extensive observations I should say that if the condition of any organ of such a guinea-pig is indefinite as regards indication of Cholera Asiatica it is that of the intestine. Moreover, I learn from Mr. Haffkine himself that the above statement of Hankin is not justified by Haffkine's own observations. A distended condition of the intestine with more or less fluid or viscid sanguineous contents, does no doubt occur in a certain per-centage of cases; but in a good number it is not present, and, as I shall presently show, the assumed choleraic condition of intestine results when the intraperitoneal injection is made with organisms other than the cholera microbe.] The *cavity of the peritoneum* contains turbid slightly, or much, blood-tinged exudation, in which there are few or many flakes of greyish lymph. Nevertheless in the cavity of the peritoneum there is always turbid exudation after injection of the cholera microbe; all gradations occur from a small amount of a viscid nature up to copious (10 c.c. or more) blood-tinged fluid. I find that as a rule the sooner the animal dies the less likely is the exudation to be copious; if death occurs not earlier

than after 20 hours it is as a rule copious. Haffkine states that the less copious the exudation the more crowded will it be found with the cholera vibrios used for the injection. My observations do not, however, bear this out; the most copious exudation is sometimes densely packed with the mobile vibrios, as is proved by cover-glass specimens and by cultivation. Figs. 22, 23, and 24, Plate VIII., and Fig. 26, Plate IX. show the condition of things in such copious exudations. Nor do I find, as Haffkine indicates, that small guinea-pigs more often contain copious exudation and full-grown guinea-pigs less copious exudation in their peritoneums; for I have repeatedly made the injection simultaneously, using the same quantities in one full-grown and in one small guinea-pig, and have not found such a difference; both had very copious exudation densely crowded with the vibrios. Moreover, transferring such peritoneal exudation indiscriminately to large or to small animals, the result was again the same in both. The blood taken from the *heart* contains the microbes; cover-glass specimens, better still culture experiments, prove this conclusively. Using for a gelatine plate cultivation a drop of the heart's blood, an abundance of colonies of the cholera vibrio are as a rule obtained; not so numerously indeed as from the peritoneal exudation, for this is crowded with them, but sufficiently numerous to say that the blood contains the microbes fairly abundantly. Amongst the very large number of experiments (intraperitoneal injections) that I have made both with the cholera bacillus, with the peritoneal exudation of guinea-pigs dead after such injections, and with cultivations corresponding to Haffkine's *virus fort*, I do not think that the vibrios have been absent from cultivations of the blood more than once; and it would have been certainly remarkable to find the microbes absent from the blood in anything like a considerable per-centage of cases, considering that they are so abundantly present and multiply so readily in the peritoneal cavity, and that there is no reason why they should not, like any other materials, be easily absorbed from the peritoneal cavity.

physiological results.

In these animals into whose peritoneal cavities the cholera bacillus has been injected, we have a condition of things—intense acute peritonitis, the microbes injected being abundantly present in the peritoneal exudation and fairly abundant in the heart's blood—which does not present any features characteristic of Cholera Asiatica. Nor do the symptoms of the disease during life indicate any specific illness. Moreover, as we shall see presently, the same symptoms and the same post-mortem appearances occur in guinea-pigs which have been intraperitoneally injected with microbes other than the cholera vibrio. Whatever therefore the exact relation of the cholera vibrio to Asiatic cholera, the result of the intraperitoneal injection of it in large amount into the guinea-pig certainly affords no proof that this vibrio stands in a causal relation to Asiatic cholera. It only proves that by such methods an acute intense peritonitis with a general infection of the blood by the microbe is produced; a result not of specific character, but appertaining to a variety of other microbes, some of which have no relation whatever to disease in man.

Certain interesting points arise in connexion with the morphology of the cholera vibrio passed through the guinea-pig in the above experiments which need to be referred to:—Not only are the vibrios in the peritoneal exudation of the ginea-pig as a rule extremely minute, sometimes conspicuously shorter than those of the original cholera cultivation; but in addition they are less curved when taken from a culture made of such peritoneal exudation. Both in gelatine and in agar cultures of such

exudation, the vibrios appear so little curved that on comparing them with a typical cholera cultivation it might at first be thought that they were not cholera vibrios at all; but on closer examination with a high power, one or another bacillus is found that exhibits distinctly a comma-shape. Figs. 25 and 27, Plate IX., represent impression preparations of pure colonies of the vibrio from the peritoneal exudation, and it will be observed that the great majority of the microbes constituting these colonies appear anything but vibrios. Yet there can be no doubt whatever about their being so, for on making plate cultivations every colony presented all the characters of typical cholera vibrios. And further, on establishing a series of subcultures of the organisms in gelatine plates for two or three generations, they again assumed both their typical length and their typical curved shape. In a few instances only have I noticed that the vibrios in the peritoneal fluid are considerably thicker and beautifully curved, and of such a case Figs. 23 and 24, Plate VIII., are illustrative.

Dead cholera vibrios intraperitoneally injected.

Injection of dead Cholera Vibrios.—The disease and the post-mortem appearances observed in the preceding experiments are producible in the guinea-pig, if instead of using scrapings of *living* cultures these scrapings are *sterilised* previous to injection into the peritoneum. Pfeiffer (*l.c.*) has noticed also this action of sterilised cholera cultures, and on account of the fact that only the bacilli themselves (not their chemical products) are injected, he rightly concludes that the substance which produces this poisonous action must be lodged within the bacilli themselves. In my own experiments, as also in those of Haffkine, the bacilli themselves were used for the injection. And in the experiments with sterilised cultures now under consideration, the bacilli themselves, killed before they were injected, produced in guinea-pigs exactly the same disease as the living microbes; the only difference that I can notice, and to this I shall presently return, being that the sterilised scrapings, in order to produce on intraperitoneal injection the fatal result, must be injected in somewhat larger doses than the living microbe.

In proceeding to actual experiment, an agar culture on the slanting surface of which the vibrios have been growing is, as before, used. The growth, having been scraped off from the whole surface of the agar, is distributed, by shaking, in 5 c.c. of sterile beef broth. This is then poured off into a sterile test tube which is exposed to 62°–65° C. for 10–15 minutes. In this way all life of the microbes contained in the scrapings is destroyed; no living subculture can be made from them. If of such a sterilised mixture $\frac{1}{6}$th of the test tube be injected peritoneally into a guinea-pig, the animal will be found to show only transitory illness; as a rule it will have recovered again after a day or two. This result is occasionally produced when a larger quantity, as, for instance, $\frac{1}{3}$ of a test tube is used, though the probabilities are that the animal succumbs in 24 to 36 hours. In order therefore to produce with certainty a quickly fatal result, it is necessary to use of the sterilised culture at least $\frac{1}{2}$ of the growth.

The symptoms and course of the disease and the pathological appearances produced in the guinea-pig after the intraperitoneal injection of a fatal dose of sterilised cholera microbes, are in every respect identical with those described in regard of the living microbes, with the exception, of course, that the peritoneal exudation and the heart's blood are found free of the vibrio. The important question therefore arises from these experiments:—How is it that, in equal amount, the living microbe acts more virulently than the sterilised one? There can be no question that in all these experiments the bacilli themselves were injected, not their chemical products in the culture medium. The growth, consisting

of the microbes only, or chiefly, had been scraped off from the culture medium without removing any of the nutritive medium itself; it (the growth) was then distributed in sterile bouillon, and this mixture was injected. Consequently any poisonous action produced by the injection of this mixture must be ascribed to the microbes themselves, whether living or dead; and therefore the bodies of the bacilli *per se* must contain the poisonous matter. As to the reason for the difference of dose of living and of dead microbes required to produce a given result, it will have been noticed that in the experiments with the living vibrio, the microbes multiply to a considerable degree within the peritoneal cavity; for it has been shown that in 20 to 24 hours the peritoneal fluid is teeming with them. But when the sterilised culture is used there is, of course, no multiplication of the bacilli possible in the peritoneal cavity, for no living microbes were injected. It becomes obvious then that in experiments with scrapings from the living culture, the original dose (*i.e.*, that used for injection) of the intracellular poison required for a fatal result need not be so great as in experiments with sterilised scrapings; for the bacilli introduced in a living state can multiply within the peritoneal cavity, and so supplement the dose of the intracellular poison originally introduced till it reaches the fatal amount. There is also another reason why the dose of living culture injected need not be so great as that of the sterilised culture. It has to do with the chemical substances (poisonous) produced by the living bacilli while growing and multiplying within the peritoneal fluid. We know indeed from the observations of many previous workers (Von Ermengen, Hueppe, MacLeod Mills and others) that the cholera vibrios growing in animal substances and in the fluids of the body produce virulent chemical substances.

II.—Subcutaneous Injection of the Cholera Vibrio.

Subcutaneous injection into the groin of a guinea-pig of a dose of scrapings of agar culture such as acts fatally intraperitoneally, causes in that animal a general but transitory illness. The experimental animals are found quiet the next day and do not feed; but after a further day or two they seem quite right again. The local effect is, however, more definite, inasmuch as a soft swelling is found at and about the seat of the inoculation. This soft swelling enlarges for a few days, then gradually becomes firmer and smaller, and either gradually altogether disappears or leads to a necrosis and ulceration of the skin, which soon completely heals. Both the general effect and the local tumour, are most pronounced if the injection is made into the muscles of the anterior abdominal wall instead of into the subcutaneous tissue of the groin. In this latter case the local soft tumour is very pronounced and extensive, and though in a few days it has diminished in size and become firmer, it generally leads to necrosis and ulceration of the skin. The same characteristic results are obtained if the subcutaneous, or better the intermuscular injection, is made with the peritoneal exudation from an animal of No. I. series in a dose that would be fatal intraperitoneally.

Subcutaneous injection of the cholera vibrio; living.

The sterilised scrapings act, when subcutaneously injected, in the same way as the living microbe; and as in the case of the intraperitoneal injections, the dose of the sterilised scrapings in subcutaneous injection has to be larger than that of the living microbe in order to produce a like degree of intensity of result.

We see then from these experiments of Series II. that they are identical in character with those that were obtained by Haffkine by means of subcutaneous injection of his *virus fort.*

As has been already mentioned, Pfeiffer (*l.c.*) produced in the guinea-pig by intraperitoneal injection identical results with the vibrio of cholera, the vibrio of Metschnikoff, and the vibrio of Finkler; and I proceed now to describe the results obtained by me with the following microbes:—

Other microbes similarly tested:

(*a.*) The vibrio of Finkler
(*b.*) The bacillus prodigiosus;
(*c.*) The proteus vulgaris;
(*d.*) The bacillus coli;
(*e.*) The bacillus of typhoid fever; and
(*f.*) The staphylococcus aureus.

In all my experiments with these species inoculation was made both intraperitoneally and subcutaneously of different guinea-pigs; and in all instances, both as regards the mode of preparing the material for injection and the amount of the living or sterilised material used, procedure was exactly the same as in my experiments with the cholera vibrio. It is not necessary therefore to repeat the various steps which have been described in detail on previous pages.

A.—Intraperitoneal injection of living Microbes of different species.

by intraperitoneal injection;

Injection into the peritoneum of the guinea-pig of $\frac{1}{3}$–$\frac{1}{2}$ of the scrapings from a culture tube of any one of the above organisms is followed by the same general disease and by the same acute intense peritonitis, with death within 20–24 hours, which were described in regard of the cholera vibrio; any essential difference in the nature of the symptoms during life or in the character of the changes present at the post-mortem examination, could not be discerned.

A few hours after the injection the animals are quiet, they do not feed, they huddle themselves up, and their temperature is lowered. As time goes on their conditions becomes worse, motility becomes impaired, they are unwilling to walk, and are shaky and unsteady. As a rule they are found dead the next morning, before 24 hours are over. On post-mortem examination the *peritoneum* is found intensely inflamed, *i.e.*, great congestion often with hæmorrhage; the *serous covering* of the stomach is deep red; the *liver* and *omentum* are covered with more or less continuous layers of grey pseudo-membranes, and the *peritoneum* contains more or less copious turbid fluid, often sanguineous exudation containing flocculi of lymph. This *peritoneal exudation* is crowded with the microbes injected, as is shown by examination of fresh cover-glass specimens* and by culture. The *heart's blood* also contains the microbes in a fair number, as is shown by culture experiment. The crowded condition of the peritoneal exudation with the microbes used for injection is well illustrated in the figures above referred to.

As regards this exudation, certain morphological differences are now and again noticeable in the contained organisms:—the vibrio of Finkler, the bacillus prodigiosus, the bacillus of typhoid, and the staphylococcus aureus. These morphological points are as follows:—(*a.*) As is shown in fig. 28, Plate X., the vibrio of Finkler is sometimes found to exhibit a peculiar pointed appearance of the individual commas, though this is not noticed in all the vibrios from the same exudation; (*b.*) the typhoid

* *See* Figs. 28, 29, and 30, Plate X.; Fig. 33, Plate XI.; and Figs. 34, 35, and 36, Plate XII.

fever bacillus of the peritoneal exudation of the guinea-pig, compared with the bacillus coli from the same locality, is markedly more cylindrical and longer, and shows the characteristic bipolar accumulation of its protoplasm referred to in my report on typhoid fever; (*c.*) the staphylococcus aureus is in some cases found crowded within the leucocytes (see fig. 36, Plate XII.), though also under these conditions many, singly and in large and small clusters, are found free in the fluid; (*d.*) the bacillus prodigiosus is often found forming chains, some of them composed of six or eight elements.

And just as was the case in the experiments with the cholera microbes, so also with these other microbes the condition of the intestine and of the peritoneal exudation is liable to variation in different instances. The intestine may be contracted, or it may be relaxed and filled with sanguineous more or less fluid mucus; sometimes the injection of its serous coat is slight, sometimes very marked. And the peritoneal exudation may or may not be found conspicuously tinged with blood. A further important point is that not all these species act with the same virulence, although the symptoms of the disease and the pathological changes are of the same nature; the fatal dose required and the intensity produced by a like dose, are not the same in all species. The bacillus prodigiosus, the bacillus coli, and the bacillus of typhoid fever act in these respects with more virulence than the cholera vibrio, the vibrio of Finkler, and the staphylococcus aureus.

But an important point in regard to the analogy existing between the results produced by the intraperitoneal injection of these microbes and by intraperitoneal injection of the cholera vibrio, is the fact that as with the latter so also with the former, the transmission of material from peritoneum to peritoneum through a series of guinea-pigs produces a marked increase in the virulence of the peritoneal exudation. This is well illustrated in the series of experiments which I have carried out with the bacillus coli and the bacillus of typhoid fever. As early as after two transmissions the peritoneal exudation possesses in both cases such virulence that a few drops of it injected subcutaneously may, and does often, cause a fatal effect; whereas a considerably larger dose of the original scrapings ($\frac{1}{5}$–$\frac{1}{3}$ of the growth in a culture tube) fails to produce more than a local tumour. Also the vibrio of Finkler transmitted similarly through a few guinea-pigs produces a peritoneal exudation of considerable virulence; a few drops of this injected into the muscle of the anterior abdominal wall produces a big tumour, leading later on to necrosis and ulceration of the skin.

[A curious result was obtained in one series of experiments involving the intraperitoneal injection of bacillus prodigiosus. A series was started by injecting a guinea-pig—let it be called (*a.*)—intraperitoneally with $\frac{1}{3}$ of the scrapings of a pure culture on agar of the bacillus prodigiosus. The animal was found dead next morning, within 20 hours. In the peritoneal cavity there was copious turbid sanguineous exudation with large masses of grey membranes on the liver and omentum. As in other instances, cultivations were now set up from the peritoneal exudation, at the same time that intraperitoneal injection with a Pravaz syringe of this exudation was made into a fresh guinea-pig (*b.*). This latter animal was dead within 16 hours and showed the usual post-mortem appearances. From its copious peritoneal sanguineous exudation cultures were made, and a fresh guinea-pig (*c.*) injected with the peritoneal fluid. This animal died with the usual appearances within 16 hours, and from its turbid sanguineous peritoneal exudation cultures were in turn made, at the same time that a fresh guinea-pig (*d.*) was injected with it. From this again the same procedure was adopted

and a guinea-pig (*e.*) injected. By the time this point was reached the cultures (all on agar) made from guinea-pigs (*a.*) and (*b.*) showed the curious appearance of a greyish-white growth amongst a pink growth, this latter being of course the bacillus prodigiosus; and it was at the same time noticed that whereas in the cultures made from the exudation of guinea-pig (*a.*) the prodigiosus growth greatly exceeded (in number of colonies) that of the greyish-white growth, the reverse was the case in the cultures from the peritoneal exudation of guinea-pig (*b.*). And further, on examining those made from the peritoneal exudation of guinea-pigs (*c.*) and (*d.*) this disproportion was still more striking; so much so that in the cultures of the peritoneal fluid of guinea-pig (*d.*) there were only very few colonies of the bacillus prodigiosus, the main growth being the greyish-white colonies. Finally as regarded guinea-pig (*e.*), neither from the peritoneal exudation nor from the blood was growth of the bacillus prodigiosus obtained; there was here pure cultivation of the greyish-white growth alone. From this we see then that in the peritoneal exudation of guinea-pig (*a.*) there was present the bacillus prodigiosus intentionally injected, and another microbe not intentionally injected; and that in the successive series of guinea-pigs used in transferring peritoneal exudation from one to another animal, the prodigiosus bacillus was gradually outcrowded and ultimately suppressed; so that by the fifth generation of animals the bacillus prodigiosus had completely disappeared. Now this greyish-white species proved itself extremely virulent. For subcutaneous injection into guinea-pigs of small quantities of a pure culture from a few drops of the peritoneal exudation of guinea-pig (*e.*), caused death in a day or two with extensive malodorous œdema and hæmorrhage(as much as is found in true malignant œdema of Koch) about the seat of inoculation, great congestion of the viscera, with sanguineous pleural pericardial and peritoneal exudation. The heart's blood, the fluid of the subcutaneous œdema, and the various exudations contained at the same time the microbe very abundantly. (Fig. 31, Plate XI.)

Morphologically the organism resembled to a very large extent the bacillus coli. Also it resembled that organism to a large extent in culture. But as regards virulence there could be no doubt about there existing a very obvious difference between the two. Dr. Andrewes in his report in this volume gives further details as to this very interesting microbe. How this microbe got entrance into the peritoneum of guinea-pig (*a*); whether it was accidentally introduced from outside, or whether it got into the peritoneum from the alimentary canal of this animal, I am not able to say. The latter source is obviously the most probable one, since the prodigiosus culture used at starting was perfectly pure, and the instruments used for inoculation were reliably sterile. Further, it is likely enough that this motile superadded bacillus got into the peritoneal cavity, either through a prick of the alimentary canal caused by the needle of the syringe used for the intraperitoneal injection, or through the disorganised wall of the alimentary canal when the animal had become some time ill with peritonitis and was moribund.]

B.—Intraperitoneal injection of the above several microbes, after subjection to 60°–62° C. for 10–15 minutes.

This produces the same result as the living microbe; but with this difference. As in the experiments with the vibrio of Koch so also here the amount of the dead organisms has to be somewhat larger than that of the living; but in the nature of the illness produced and in the post-mortem appearances, there is no difference.

C.—Subcutaneous injection of the different microbes.

These all act when subcutaneously injected in the same way as the cholera vibrio under like conditions. As in that case, injection into the muscle of the anterior abdominal wall produces a more conspicuous swelling than that into the subcutaneous tissue of the groin. In this series of experiments also the virulence of the bacillus prodigiosus, of bacillus coli, and of the bacillus of typhoid fever, is greater than that of the others; so much so that in several instances the subcutaneous injection of half the scrapings from a culture tube of either of these three was followed by such severe general illness that death supervened after two to three days. And smaller amount, such as $\frac{1}{3}$, $\frac{1}{4}$, or $\frac{1}{8}$ of the scrapings from a single culture tube, is sufficient to produce a very marked general and local disease.

by sub-cutaneous injection.

To sum up at this stage:—The conclusion that, I think, can be justly drawn from these experiments is that the bacteria of each of these different species,—the vibrio of cholera, the vibrio of Finkler, bacillus prodigiosus, proteus vulgaris, bacillus coli, bacillus of typhoid fever, and staphylococcus aureus,—contain in their bodies a poisonous substance which, when injected in sufficient amount *into the peritoneum* of the guinea-pig, causes a malady that is, for all these species, in its nature and result exactly the same. So also by *subcutaneous injection* of the guinea-pig with these microbes, we get for each of them the same general and the same local disease; always provided that the bacteria are introduced in sufficient amount. Be it observed that in all these experiments the bacteria themselves, *minus* the chemical products elaborated by them in the nutritive media (their ptomaines, toxines, albumoses), were used for the injection. The microbes were grown on the surface of solid agar, scraped off from this, distributed in sterile broth, and injected either in the living condition or after having been sterilised. It follows, therefore, that the substance or substances which cause the disease and pathological changes witnessed, must be lodged in, or be part and parcel of, the bodies of the bacteria; and for this reason we may call these substances *intracellular poisons*, always remembering that their poisonous nature manifests itself in the guinea-pig only when injected in large doses. Finally, it having been shown that the changes produced in the guinea-pig by intraperitoneal or by subcutaneous injection of any of the above species are of the same kind, we must conclude that *the intracellular poisonous substance in all these species is of the same nature.*

Summary and inference.

The intracellular poison.

A further conclusion that I think must be drawn from the above experiments is, that the view of Haffkine and his followers *as to the specific choleraic nature of the disease induced in the guinea-pig by the intraperitoneal injection of the cholera bacillus, is absolutely untenable.* For apart from the dissimilarity from cholera Asiatica of the disease—acute intense peritonitis—thus produced, there is this striking fact, namely, that exactly the same disease is produced by the same methods with any one of the above enumerated bacterial species; and since neither the bacillus prodigiosus, nor the vibrio of Finkler, nor the staphylococcus aureus, can be said to produce cholera in the guinea-pig, the identical condition produced in the guinea-pig by the vibrio of cholera is not to be regarded as the equivalent of cholera Asiatica. On the same grounds the views of Rodet and Roux as to the identity of the bacillus coli and the bacillus of typhoid fever, on account of their producing the same results on injection into the guinea-pig (a subject dealt with in my report in this volume on the Etiology of Typhoid Fever), must be regarded as not established. Their results in question do not differ from those

not specific in its nature.

produced by the vibrio of Finkler and by the bacillus prodigiosus, two species as widely different from one another as any two species can be.

III.—Protective Inoculations.

Haffkine's protection against cholera;

As has been mentioned in the introduction to this report, M. Haffkine by oft repeated transmission of the vibrio of cholera from peritoneum to peritoneum of the guinea-pig, obtains ultimately from the peritoneal exudation cultures which possess a high degree of virulence; so much so that a considerably smaller fraction than before of the culture scrapings produces a fatal result on intraperitoneal injection. Of such a culture of the *virus fort* $\frac{1}{15}$, or even $\frac{1}{32}$ part acts as virulently as a $\frac{1}{2}$ or a whole culture scraping of the original material. Now on *subcutaneous* injection into guinea-pigs of repeated small amount of scrapings from a culture of the *virus fort*, Haffkine found that guinea-pigs thus dealt with prove refractory against the intraperitoneal injection of otherwise fatal doses of the *virus fort*. He concluded that by such preliminary subcutaneous injections of this *virus fort* a "cholera-poison firm" condition can be produced in the guinea-pig.* And further he inferred that by subcutaneous injection of this *virus fort* into human beings a protection against cholera infection might possibly be effected. Haffkine accordingly inoculated himself, Roux, Hankin, and others subcutaneously with his *virus fort*, and caused thereby a general and local disturbance similar in nature (except the local necrosis and ulceration) to that observed in the guinea-pig; and he proposes to carry this out on a large scale on human beings with a view to establishing in them a temporary poison-firm condition against cholera.

tested in further experiments

Let us then examine by means of my own experiments the facts of the case, and ascertain how far the inferences of Haffkine are or are not borne out by these facts.

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* In illustration of the nature of Haffkine's experiments I quote from a paper by Professors Wright and Bruce published in the "British Medical Journal," February 4, 1893, in which a full account is given of Haffkine's modus procedendi and of the results obtained by him on the guinea-pig:—

"Guinea-pig 1.—Vaccinated with carbolised first vaccine on January 17, 1893; vaccinated with carbolised second vaccine on January 20, 1893; inoculated intraperitoneally with 1–6 tube of exalted virus January 23, 1893. Result: Died on morning of January 25, 1893.

"Guinea-pig 2.—Vaccinated with carbolised first vaccine on January 17, 1893; vaccinated with carbolised second vaccine on January 20, 1893; inoculated intraperitoneally with 1–8 tube of exalted cholera virus on January 23, 1893. Result: Alive and thoroughly recovered from cholera inoculation on January 24, 1893.

"Guinea-pig 3.—Vaccinations and cholera inoculation exactly the same as in the case of Guinea-pig 2. Result: Alive and thoroughly recovered from the effect of cholera inoculation on January 24, 1893.

"*Control Animals.*

"Guinea-pig 4.—Received an intraperitoneal injection of 1–8 tube of exalted virus on January 23, 1893. Result: Dead by next morning.

"Guinea-pig 5.—Received an intraperitoneal inoculation of 1–16 tube of exalted cholera virus on January 23, 1893. Result: Dead by next morning.

"Guinea-pig 6.—Received an intraperitoneal inoculation of 1–32 tube of exalted virus on January 23, 1893. Dead on morning of January 25, 1893.

"It will be seen that in this experiment the lethal dose for the vaccinated guinea-pig was more than five times as large as the lethal dose for the unvaccinated guinea-pig (1–6 tube as compared with 1–32 tube). Further it will be seen that almost complete tolerance had been established by these vaccinations for four times the lethal dose of cholera virus (1–8 tube tolerated by the vaccinated guinea-pigs as compared with 1-32 tube lethal for the unvaccinated guinea-pig)."

A.—Protective inoculation by intraperitoneal injection of living Cholera Microbe.

with living cholera vibrio;

As mentioned in the first of my series of experiments with the living cholera microbe, the intraperitoneal injection of a non-fatal dose (less than $\frac{1}{5}$ of the scrapings of a single tube) produces a transitory illness for a few days, after which the animals become again seemingly all right. If these animals are then subjected to a fresh injection with an ordinarily fatal dose—as tested on a control guinea-pig—(say $\frac{1}{3}$ or $\frac{1}{2}$ scrapings of a culture tube), they will usually be found refractory; that is to say, they show a temporary general illness—they are quiet and do not feed for a day—but soon are all right again. A subsequent second or third intraperitoneal injection of otherwise fatal doses leaves these guinea-pigs unharmed. If, however, on re-injection of a larger dose than is required to produce a fatal result in a control guinea-pig, a given animal succumbed (as sometimes happened) with acute intense peritonitis, it was found that the peritoneal exudation did not necessarily contain the living microbes. This was ascertained by the culture test; sometimes only a few, in other cases no colonies of the bacilli could be recovered by cultivation. And it was difficult to understand at first how, seeing that the injection proved fatal, the multiplication in such an animal of the microbe should be so greatly or altogether inhibited as is the case. But I think this result is explicable by bearing in mind that within an animal injected in the first instance with a non-fatal dose of the living microbe, there are going on two processes at one and the same time; viz. (*a.*) the action of the intracellular poison contained in the bodies of the bacteria injected, plus that contained in the bodies of the bacteria multiplying in the peritoneal cavity; and (*b.*) the action of the chemical substances resulting from the metabolism produced by the microbe in the peritoneal fluid of the experimental animal. If these two substances are different, as we may suppose they are, then the action of this second set of substances, viz., the chemical products manufactured in the peritoneal fluid, would be the very action by which the multiplication of the same microbe would, on its subsequent re-injection, be likely to be inhibited. By inhibition in this sense indeed, the protective inoculation to be obtained by means of the toxines of specific bacteria has so often and so successfully been demonstrated in the numerous experiments. In anthrax it has been shown (Hankin, Sidney Martin, and others) that injection of the chemical substances produced by the anthrax bacilli in certain albuminous culture-media, is capable of protecting against a second successful inoculation of anthrax bacilli; that is to say, is capable of rendering the animal an insusceptible soil for the growth of the anthrax bacillus. The same has been shown for tetanus, for septicæmia, and for other diseases. And accordingly I am disposed to refer the non-multiplication of the cholera vibrios in the peritoneal cavities of guinea-pigs injected a second time with an extra dose of the living cholera microbe, not so much to the intracellular poison introduced at the first injection, as to the toxine resulting from the life processes of the cholera vibrio in the peritoneal cavity as a result of the first injection.

B.—Protective inoculation by sterilised scrapings from culture of Cholera Microbe.

with dead cholera vibrio;

The tolerance acquired by a guinea-pig as a result of intraperitoneal injection of a non-fatal dose of living cholera microbes holds good also for the culture scrapings that have been sterilised. The injection of this

material in non-fatal dose usually protects a guinea-pig against a second injection of an otherwise fatal dose of the living or non-living microbe. In the cases in which it does not thus protect, an important confirmation is afforded of the view just set out as to a twofold action going on in the animal injected the first time with a non-fatal dose of *living* culture. If the second intraperitoneal injection, carried out with an extra dose of the living cholera bacilli, kills the animal with acute intense peritonitis, the peritoneal exudation *will be found crowded with the living bacilli*, as shown by microscopic specimens and by culture experiment. Obviously therefore the first injection of sterilised culture did nothing more than introduce into the guinea-pig a certain amount of the intracellular poison; the other process, viz., the production of the toxines that would inhibit, on a re-injection of living microbes, the subsequent multiplication of the microbes in the animal, had been here wanting.

C.—Other Species.

with other species of microbes.

Precisely the same results as regards protection have been achieved with all the other species mentioned on page 374; but as the experiments about to be recorded were chiefly carried out with the vibrio of Finkler, the bacillus prodigiosus, the bacillus coli, and the typhoid bacillus, what I have now to say is to be taken as especially referring to these species.

Just as was the case with the living and sterilised vibrios of cholera, so also with the microbes of the four species above enumerated, a first intraperitoneal injection of a non-fatal (but sufficiently large) dose of the living or of the sterilised microbes of any one of them, produces a transitory illness in the guinea pig; after two or three days the animal is seemingly well again. If now a second intraperitoneal injection of the same species is made, it will be found that unless the dose is excessive (that is so long as the dose is not larger than just suffices to kill a control guinea-pig), the animal remains alive; so that by the first injection it has acquired a tolerance of an otherwise fatal second injection. And just as in the series of protective experiments with the cholera vibrio, so also here, a first injection of a non-fatal dose of the *living* microbes rendered the animal refractory against multiplication of the microbes in the peritoneal cavity as a result of a second injection with an excess of the living microbes. As before too, if the first injection is made with *sterilised* microbes, such a multiplication was not prevented. So that all these microbes—the vibrio of cholera, the vibrio of Finkler, the bacillus prodigiosus, the bacillus coli, and the bacillus of typhoid fever, stand on exactly the same footing as regards the effect upon the guinea-pig by a first injection of their intracellular substance.

It has now to be shown that in this sense each protects against the others.

D.—Reciprocal Protection.

Antagonism of intracellular poisons from different sources.

(*a.*) *By peritoneal injection.*—A remarkable relation existing between the different species enumerated is that, not only does a first intraperitoneal injection of a non-fatal dose of a given microbe furnish the experimental animal with tolerance of a second intraperitoneal injection of the same microbe, but also against intraperitoneal injection of any one of the others. A considerable number of guinea-pigs which had survived the intraperitoneal injection of a non-fatal dose of the vibrio of Finkler, of the bacillus coli, and of bacillus prodigiosus respectively, were re-inoculated by me per peritoneum with an otherwise fatal dose of the cholera vibrio (some of them repeatedly with a fatal dose of Haffkine's

virus fort); but they all survived. This reciprocal protection is then further strong confirmation that the intracellular poison of all these species is identical. In these experiments it is necessary to bear in mind that, whatever the microbe of experiment, if the dose of the intracellular poison of the first injection is not sufficiently large, tolerance against a second injection of a large dose of the intracellular poison of another species will be found very small or nil; the animal will succumb. Preliminary experiments with each particular microbe have therefore to be tried to ascertain what is just the fatal dose, so that by this the amount to be used for the first injection may be regulated. It is further necessary to bear in mind that though a reciprocal protection is exerted by the intracellular poisons of the different species, this is not necessarily the case as regards the chemical substances manufactured by them in the media in which they are grown. But to this subject I shall have to recur further on.

(*b.*) *By subcutaneous injection.*—Equally striking results are obtained if the experimental animals are first subcutaneously inoculated on several separate occasions with a large dose of the microbe (taken from the surface of agar), either living or sterilised. Such a proceeding furnishes the animals with tolerance against the intraperitoneal injection of otherwise fatal doses of the same or of other microbes. In this sense I have experimented with a considerable number of animals, and can, as a result, state that three or four subcutaneous injections administered (according to the general condition of the animal) at intervals of one, two, or three days, suffice to render the animal tolerant of a subsequent intraperitoneal injection, if this be performed not earlier than 12 and not later than 15 days. For each such antecedent subcutaneous injection one-fifth of the scrapings of an agar culture, previously sterilised, is used. But it must be remembered that in the case of bacillus coli, bacillus of typhoid fever, and bacillus prodigiosus, if the living microbes are used, less than one-fifth has to be injected, and that each subsequent subcutaneous injection must be suspended until the animal appears to have recovered from the previous injection.

In illustration of the fact that not only are animals furnished by such repeated subcutaneous injection of a given species with tolerance of the intraperitoneal injection of an otherwise fatal dose of the same species, but also against an otherwise fatal dose of any of the other species, I supply details of three such series which I think conclusively prove this proposition.

(*a.*) Six guinea-pigs were subcutaneously injected on four separate occasions with sterilised (subjected to 62° C. for ten minutes) agar scrapings of the *vibrio of Finkler*. One-fifth of the usual broth mixture was used for each animal on the 1st, 3rd, 4th, and 6th day. Twelve days after the last subcutaneous injection they were each injected intraperitoneally with Haffkine's culture of the "*virus fort*" of cholera, one-twelfth of the scrapings of a tube of this being used for each animal. Two control guinea-pigs injected at the same time intraperitoneally with one-twelfth of a tube of this same "*virus fort*" were found dead the next morning (within 20 hours), with the usual post-mortem appearances. But of the six "Finkler" guinea-pigs, though one died after about 30 hours, five remained alive.

(*b.*) Four guinea-pigs were each subcutaneously injected with sterilised scrapings of a *bacillus prodigiosus* culture on four separate occasions; one-fifth of the surface of an agar culture being used for each animal on the 1st, 3rd, 4th, and 6th day. Twelve days after the last

subcutaneous injection they were each injected intraperitoneally one-twelfth of Haffkine's tube of the same "*virus fort*" of c as used in series (A.). All remained alive.

(*c*.) Four guinea-pigs were subcutaneously injected on three occ with one-fifth of the sterilised scrapings of a culture of *bacillu* They were thus injected on the first, second, and fourth day. T days after, each received intraperitoneally one-twelfth of a Haf tube of *virus fort* of cholera. All remained alive.

The conclusion to be drawn from these three experiments is, I obvious, viz., that it is possible—just as in Haffkine's compl experiments—to render the guinea-pig tolerant of the intrac cholera poison, even if the latter be administered intraperitonea what would otherwise prove a fatal dose, by previous repeate cutaneous injections of the intracellular poison, indifferently c vibrio of Finkler, of the bacillus coli, or of the bacillus prodigiosus that we have in this a complete confirmation of my original propo namely, that these different species contain within their bacilli o the same poisonous substance.*

Physiological considerations.

But while this conclusion is justified, does it follow from experiments, or from those of Haffkine, that by rendering a given s tolerant of the intracellular poison of a particular microbe, this ani at the same time rendered also tolerant of the toxins, albumoses, &c., such microbe is apt to produce in culture media and from the tiss its host? I think not. These experiments furnish, I maintain, no evi that such a real refractory condition is their result. True, Haffkine tains that guinea-pigs injected subcutaneously with his *virus fort* b tolerant not only of the intraperitoneal injection of otherwise doses of the cholera microbe, but also of their intra-intestinal duction:—administered that is after the well-known method of per os, the gastric fluid of the experimental animal having been viously neutralised by sodic-carbonate, and its peritoneal cavity h also been injected with tincture of opium. I am unable to judge c contention, as I have not repeated this set of experiments.† But have on other occasions maintained, this method of experimentatio no claim whatever to be regarded as imitating a casual infection cholera such as occurs in the human subject. Elsewhere I have p out that even in the guinea-pig this method of Koch yields negative results when the intraperitoneal injection of the tinctu opium is left out, or if instead of tincture a watery extract of opi used. I cannot therefore,—assuming Haffkine's contention to be c as to the refractory state of his guinea-pigs against the intra-inte administration of the cholera culture,—admit that the results of kine's experiments with his protective subcutaneous injections j the inference that such subcutaneous injections of the human s would probably protect man for a time against a natural infection cholera. Haffkine after all uses for his protective inoculations the cellular poison only, and as I have pointed out above, such a prot would, looked at in the light of the facts I have adduced, hold only against a certain quantity of dose of the intracellular poison

* While these sheets are passing through the press, Sobernheim r (Hygienische Rundschau, III., p. 497) that, having repeated my experimen obtains precisely the same results that I obtained. Bacillus subtilis, moreover in his hands, found similarly antagonistic to the cholera vibrio.

† Since writing the above, I have found that subcutaneous injection of *viru* does not protect the guinea-pig against the illness inducible in this animal by intestinal administration of the cholera microbe. And Wassermann (Zeitsc Hygiene, XIV.) records a similar experiment.

by no means follows that such a protection necessarily includes power to inhibit multiplication of the cholera microbe within the intestine of the animal body. Thus I have adduced experiments which showed that an animal, though protected against an otherwise fatal dose of the intracellular poison by a first intraperitoneal injection of a non-fatal dose of *sterilised* microbes, may nevertheless afford a proper soil for the multiplication of the *living* microbe within its body—in the peritoneal cavity for instance; and I find no valid proof in Haffkine's experiments that the subcutaneous injection of a dose of the intracellular poison of the cholera vibrio, though protecting against that intracellular poison, renders the animal unfavourable for the multiplication in it of the living microbe, and secure therefore against production from its own tissues of the true toxins causing cholera. Indeed, I have further direct experimental evidence that this is not the case in the guinea-pig; for I have convinced myself of the fact that a guinea-pig rendered tolerant of the intraperitoneal injection of intracellular cholera poison by antecedent repeated subcutaneous injection of the intracellular cholera poison, is still susceptible to, and succumbs after, injection into it of the toxins that had been produced by this microbe in gelatine culture.

It is this very fundamental distinction between the intracellular poison and the toxins produced by the microbes in artificial cultures or in the animal body, which I wish to particularly insist upon. The intracellular poison may or not be the same for a series of different species, *e.g.*, those mentioned above; but their toxins may be, and, as a rule, are of diverse sorts. And further, a particular species possessing an intracellular poison of one kind, when growing and multiplying in the animal body or in artificial culture, may, and often does, form, as a result of its metabolism, a poison of a totally different nature. The following examples will illustrate my meaning more clearly. It is admitted on all hands, and has been satisfactorily established, that in certain infectious diseases the essential and specific symptoms are caused by toxins which result from the growth and multiplication of particular microbes in the animal body. In some of these diseases the symptoms may partly be due to the presence of a large amount of the intracellular poison, *i.e.*, to a large number of the microbes present throughout the body; as, for instance, in anthrax. But in others of them this certainly is not the case. Thus in tetanus and in diphtheria we find the microbes remaining as a rule limited to one locality, where they multiply and produce their specific toxins, which, when absorbed into the system, set up their characteristic symptoms. The bacilli of tetanus and of diphtheria are not distributed throughout the body and do not therefore act as intracellular poisons. Here we have then instances of a pure action of toxins. The same is maintained for cholera; for in this disease also it is assumed by Koch and all his followers that the comma bacilli grow and multiply in the alimentary canal alone, and that their toxins produced here are absorbed into the body and so set up the symptoms of Asiatic cholera. This disease therefore would, on the above assumption, also be one due to pure toxin action; the bacilli themselves not being distributed in the body (blood or tissues), the malady can be in no marked degree the result of the intracellular poison. Then there is the tubercle bacillus! This bacillus when used in the form of Koch's tuberculin, which is an extract of the bacilli themselves (previously sterilised) and containing therefore the intracellular poison, has a powerful phlogo and pyogenic action; but the living tubercle baccilli, when they are injected

into an animal, grow therein and multiply, and set up what is called tubercular deposits in its lymph glands and viscera. These tubercular deposits undergo a characteristic necrotic caseating change correlated with the formation of giant cells. Now these latter changes produced by the toxins elaborated within the animal body by the growing and multiplying tubercle bacilli, are a process which is obviously different from the purely phlogo and pyogenic action of the dead tubercle bacilli; and it is therefore clear that in the process of tuberculosis two processes go on side by side; the one due to the intracellular poison of the bacilli, the other and more specific process due to the toxins resulting from the life processes of these bacilli. How far and to what differing extent the manifestations of other infectious disorders are due to the intracellular or to the metabolic poisons of the microbes associated with each, are questions which I think call for further elucidation.

FIG. 22.

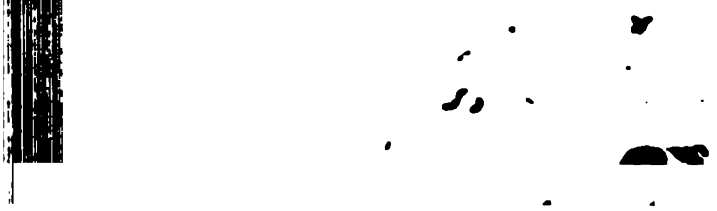

FIG. 23.

ANTAGONISMS OF MICROBES.

PLATE VIII.

FIG. 22.

Reproduced from a photograph of a cover-glass specimen of the *cholera vibrio* in pure culture. From the peritoneal exudation of a guinea-pig that died within 20 hours after intraperitoneal injection of a large dose of the cholera microbe. (Page 371.)

[Magnifying power 1,000.]

FIGS 23 AND 24.

Similar specimens of Koch's *comma bacillus* in pure culture. Certain of the bacilli are seen to be included within leucocytes. (Page 371.)

[Magnifying power 1,000.]

ANTAGONISMS OF MICROBES.

PLATE IX.

FIG. 25.

Reproduced from a photograph of an "impression preparation" of a young colony of the *cholera vibrio*. From a subculture on gelatine derived from the peritoneal exudation in the experimental guinea-pig referred to under Fig. 22 (Page 372.)

[Magnifying power 1,000.]

FIG. 26.

Reproduced from a photograph of a cover-glass specimen of the peritoneal exudation in a guinea-pig that died within 20 hours of intraperitoneal injection of a large dose of peritoneal exudation from the guinea-pig referred to under Fig. 22. (Page 371.)

[Magnifying power 1,000.]

FIG. 27.

Reproduced from a photograph of a cover-glass specimen of the *heart's blood* of a guinea-pig that died after intraperitoneal injection with the cholera vibrios from the guinea-pig referred to under Fig. 22. (Page 372.)

[Magnifying power 1,000.]

FIG. 25.

FIG. 26.

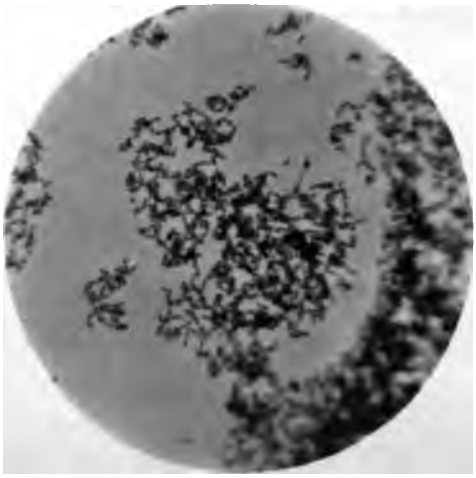

FIG. 27.

PLATE X.

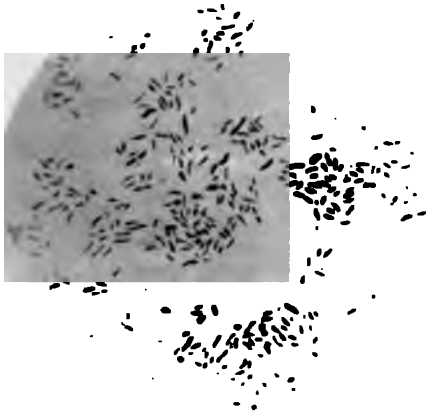

FIG. 28.

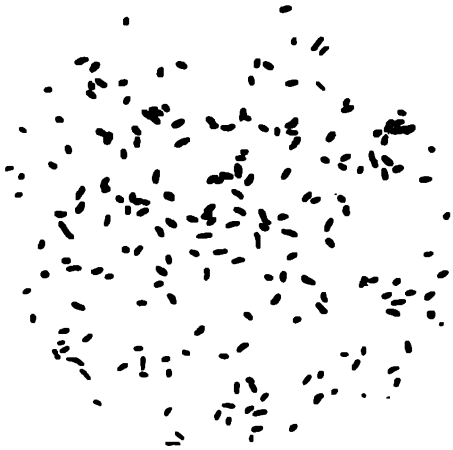

FIG. 29.

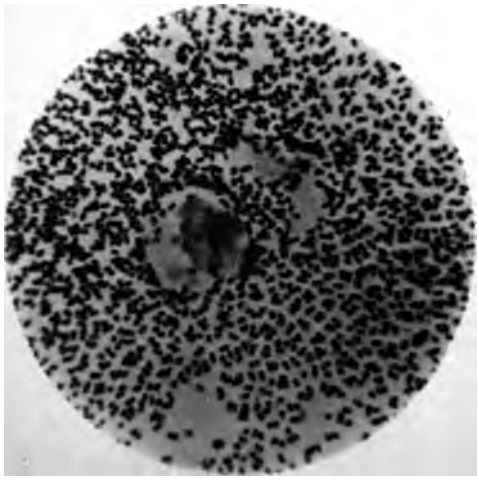

FIG. 30.

ANTAGONISMS OF MICROBES.

PLATE X.

FIG. 28.

Reproduced from a photograph of a cover-glass specimen of the peritoneal exudation from a guinea-pig that died after intraperitoneal injection of a large dose of scrapings from an *agar* culture of the *vibrio of Finkler*. (Page 374.)

[Magnifying power 1,000.]

FIG. 29.

Represents a similar specimen from another guinea-pig dealt with in like manner.

[Magnifying power 1,000.]

FIG. 30.

Reproduced from a photograph of a cover-glass specimen of the peritoneal exudation of a guinea-pig that died after intraperitoneal injection of a large dose of scrapings from an *agar* culture of *bacillus coli*. (Page 374.)

[Magnifying power 1,000.]

ANTAGONISMS OF MICROBES.

PLATE XI.

FIG. 31.

Reproduced from a photograph of a cover-glass specimen of the peritoneal exudation of a guinea-pig that died after intraperitoneal injection of a large dose of scrapings from an *agar* culture of *bacillus prodigiosus*. In this specimen the bacillus prodigiosus that had been injected had become superseded by an organism consisting of short motile rods; most probably identical with bacillus coli. The superadded microbe had probably made its way from the intestine into the peritoneal cavity of the experimental animal. Large leucocytes in this specimen are seen to be filled with the adventitious microbe. (Page 376.)

[Magnifying power 1,000.]

FIG. 32.

Reproduced from a photograph of a cover-glass specimen of the peritoneal exudation of a guinea-pig that died after intraperitoneal injection of a large dose of scrapings from an *agar* culture of the "typhoid bacillus." In certain of the bacilli bipolar staining is well seen. (Page 374.)

[Magnifying power 1,000.]

FIG. 33.

Reproduced from a photograph of a cover-glass specimen of the peritoneal exudation of a guinea-pig that died after intraperitoneal injection of scrapings from an *agar* culture of *bacillus prodigiosus*. Here and there the organisms will be observed grouped as chains. Cultures set going from the peritoneal fluid of this animal showed the bacillus to be present therein in pure culture. (Page 374.)

[Magnifying power 1,000.]

PLATE XI.

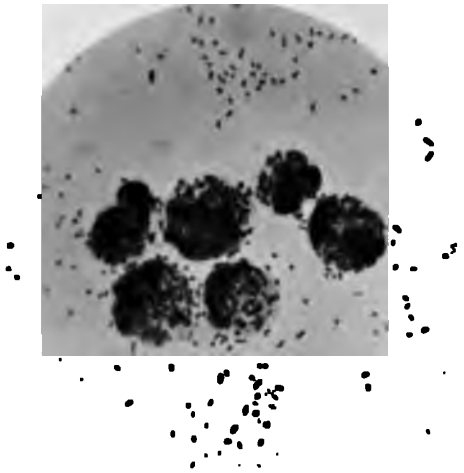

FIG. 31.

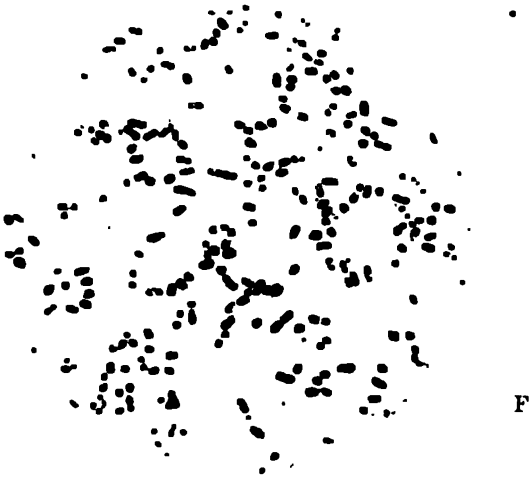

FIG. 32.

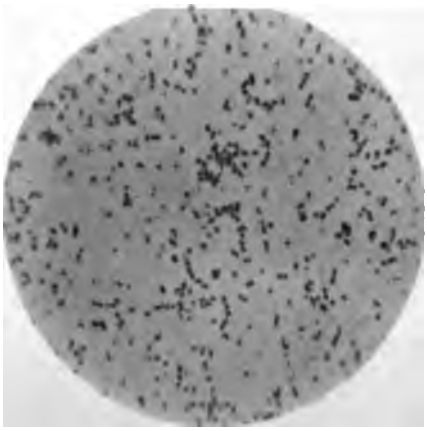

FIG. 33.

FIG. 34.

FIG. 35.

ANTAGONISMS OF MICROBES.

PLATE XII.

FIG. 34.

Reproduced from a photograph of a cover-glass specimen of the peritoneal exudation of a guinea-pig that died after intraperitoneal injection of the scrapings from an *agar* culture of *proteus vulgaris*. A large leucocyte is here seen filled with the bacilli. (Page 374.)

[Magnifying power 1,000.]

FIG. 35.

Represents a similar specimen from another guinea-pig that had been dealt with in like manner.

[Magnifying power 1,000.]

FIG. 36.

Reproduced from a photograph of a cover-glass specimen of the peritoneal exudation of the guinea-pig that died after intraperitoneal injection of scrapings from an *agar* culture of *staphylococcus aureus*. Here again leucocytes are seen crowded with the microbe of experiment. (Page 375.)

[Magnifying power 1,000.]

No. 3.

On the Etiology of Vaccinia and Variola; by Dr. Klein, F.R.S.

I.—Observation of Lymph received from Calcutta.

The Board forwarded to me, on June 20th, 1892, a wooden box containing two glass tubes (*a* & *b*.). These tubes had been received from Dr. Simpson of Calcutta along with the information that they contained in each instance a mixture of lanoline and lymph. This lymph had, as stated by Dr. Simpson, the following derivation:

Experiments with Lymph of Variolous Pedigree:

Lymph taken from a small-pox patient* on the fifth day of eruption (March 4) was inserted, into:—

Calf No. 1.

On the seventh day, *i.e.*, March 10th, lymph was taken from calf No. and transferred to:—

Calf No. 5.

On the sixth day lymph was taken from Calf No. 5 and transferred on March 15th to:—

Child No. 1. (Bonwari.)

On the fifth day (March 19) lymph was taken from child No. 1 and transferred to:—

Child No. 3. (Budia No. 1), and Child No. 4, (Budia No. 2).

On the sixth day (March 24) lymph was taken from child No. 3 and transferred to calf No. 21.

Vesicles of this calf were scraped 122 hours later (March 29), the material thus obtained was then pounded up, and mixed with double the quantity of lanoline.

Some of this mixture stored in a tube constituted sample (*a*.).

The history of lymph contained in tube (*b*) was this:—

derived indirectly from small-pox;

Calf No. 1, from which on 10th March lymph was transferred to calf No. 5, furnished on March 13th (tenth day) further lymph, which was inserted into calf No. 7. From this calf No. 7 lymph was taken on the seventh day (March 19) and inserted into child No. 5 (Basunta). Lymph from child No. 5 together with lymph, taken from child No. 4 of calf No. 1 series, was on March 25th (*i.e.*, on the seventh day) transferred to calf No. 22; the vesicles of which 105 hours later were scraped, pounded, and mixed with double the quantity of lanoline. Some of this mixture was then stored in the above tube (*b*).

With regard to his several procedures, Dr. Simpson has stated that the lymph from the small-pox patient was clear lymph; that in calf No. 1 "on the sixth day of inoculation three papules appeared in the groin and abdomen at places where there had been no punctures or incisions, and that these three papules developed the next day (March 10) into vesicles. Two of the incisions and one puncture also contained lymph. Lymph from these was taken and inserted into another calf, designated No. 5. * * Three days later (speaking of calf No. 1) the vesicles, notwithstanding the fact that lymph had been taken from them on the tenth, developed still more. On the thigh also had appeared another well-marked vesicle. With lymph from each of the vesicles a second calf, No. 7, was inoculated. * * Both calves Nos. 5 and 7 took successfully. * * Child Bonwari (child No. 1.) had at the points of insertion two splendid vesicles. * * The child's (Basunta, child No. 5) arm took splendidly.

Such being the history of the above lymph samples, I proceeded on June 23rd to test them on calves at the Brown Institution.

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* Dr. Simpson stated that this patient was suffering from a semi-confluent attack of small-pox; and that he had never been vaccinated or inoculated.

Calf No. 21*a* received the lymph of tube (*a*) (derived fro Simpson's calf No. 21) in 76 cutaneous incisions in the usual man

Calf No. 22*a* similarly received the lymph of tube (*b*) (derive Dr. Simpson's calf No. 22) in 47 cutaneous incisions in the usual m

Calf No. 21*a* showed on inspection on June 27th (*i.e.*, fifth several of the insertions red and distinctly raised; but there w vesicles. Calf No. 22*a* had at the same date most of the ins much raised, red, and distinctly vesicular. Few insertions had This calf was seen by Sir James Paget, Sir William Savor Professor Michael Foster. On June 28th (*i.e.*, sixth day) calf N showed all insertions red and raised, and a few of them gave indi of commencing vesicles. On the same day calf No. 22*a* had s vesicles typical of vaccinia. On June 29th the insertions in calf N had all become typically vesicular.

Both samples of lymph sent by Dr. Simpson produced theref the calf, at the seat of insertion, vesicles, which in all respects sponded with typical vaccinia such as is constantly raised Government Animal Vaccine Establishment. The only ob difference between the two calves was that in calf No. 21*a* the pr was one day retarded.

On the sixth and seventh days (*i.e.*, June 28th and 29th) point charged with scrapings from the vesicles of calf 22*a*, and the thus obtained inserted into calf No. 24, and, by Dr. Cory, in arms of three children. In all these the result was characteristic *va* vaccinia, that is, indistinguishable from that raised at the animal v station on calves and on children. The appearances produced No. 24 on the sixth day are shown in Plates XIII. (*a*) and XIII. (*b*) in two of the children in Plates XIV. and XV. (*a*) and (*b*) respec

The above children were kept under observation for several wee the course of their vesicles proved in every respect normal; there general eruption and in no way did they show anything differen the process of normal vaccinia.

From one of the above three children lymph was taken by Dr. C the eighth day and directly used for vaccinating five infants at St. Th Hospital. All five developed characteristic vaccinia. Plate XVI. the appearances in one of these children on the eighth day.

These five children were also kept under observation, but n abnormal was noticed in any of them.

Calves No. 21*a* and 22*a* were on July 25th (*i.e.*, after the scab the primary insertions had completely fallen off) subjected to re-va tion with the current lymph of the Animal Vaccine Establishmer lymph being inserted in each calf in over 30 incisions. But all in in both calves aborted; the attempt to vaccinate these animals complete failure.

From these experiments it follows then that the lymph sent Simpson was unmistakable vaccine lymph. The results obtained calves and on infants' arms were in every respect those of *or vaccinia*.

II.—Experiments with Lymph of Human Variola.

Series 1.

derived directly from small-pox.

Clear lymph from the vesicles of two children affected with co small-pox, was collected at the Hospital Ships* on May 24th, 1892 patients had not been vaccinated in infancy or at later periods.

* With reference to this and the next series of observations, my best tha due to Dr. Birdwood, medical superintendent of the hospital ships, for his assistance in providing me with small-pox lymph.

patient the eruption was at the third, in the other at the fourth day. The vesicles were well formed, and on pricking yielded clear lymph.

With this lymph, calf No. 1 was inoculated in 24 cutaneous incisions. No local result at any time followed; nevertheless on the seventh day the places of insertion were scraped, and the material thus obtained inoculated, on June 2nd, into a further calf (No. 3.), similarly by 24 incisions. In calf No. 3 also no result was noticeable; but on the seventh day scrapings from the insertions were as before inoculated into a further calf, No. 5, by 24 incisions. No result was obtained in this other calf.

Series 2.

Clear lymph was collected at the Hospital Ships from the following patients:—

(*a.*) L.L., ætatis 13, not vaccinated; initial illness May 23rd, confluent small-pox May 25th. Lymph collected from good vesicles on May 31st.

(*b.*) E.L., ætatis 32, vaccinated in infancy; initial illness May 20th; confluent small-pox May 24th. Clear lymph was taken from good vesicles on May 31st.

On the same day (31st May) this lymph (from both cases) was inoculated, at the Brown Institution, into calf No. 2, by 24 cutaneous incisions.

On June 4th, *i.e.*, on the fifth day, I noticed for the first time that several of the incisions in calf No. 2 were swollen and surrounded by distinct areola, while in the line of these incisions appeared thin linear scabs. But there was no vesiculation. The other insertions had almost died away, that is the skin was not swollen and was not red. I therefore put those insertions that appeared to "have taken" between forceps, scraped them, and with the material thus obtained inoculated (June 4th), a further calf, No. 4, by 24 cutaneous incisions.

On June 8th, *i.e.*, on the fifth day, four of the insertions in calf No. 4 were distinctly raised, surrounded by areola, and covered by thin scabs; but there was no trace of a vesicle. On the sixth day, *i.e.*, on June 9th, I transferred material from these four insertions (after clamping and scraping them) to calf No. 6, by 24 cutaneous incisions.

On the fifth day (13th June), all 24 insertions of calf No. 6 were raised and red, the effect being unmistakable, although no vesicle was noticed in any of the insertions. This calf was next day, June 14th, transferred to Lamb's Conduit Street, where on the same day, under all due precautions, material was taken (by clamping and scraping) from the insertions and directly transferred with perfectly sterile instruments * to a further calf, No. 8.

This was a young bull about 6 or 8 months old, and the insertions (twelve) were made into the skin of its scrotum and of its groins. On June 20th, *i.e.*, on the seventh day, six (five distinctly, one doubtfully) of the insertions in calf No. 8 had taken; that is they were raised and surrounded by areola. But no vesicle appeared, and all the other insertions had died away. From those of the insertions which looked as having "taken," scrapings (after clamping) were obtained, and inserted by Dr. Cory into five places on the arm of an infant (L ——); care being taken of course that the forceps used for the clamping and the lancet

* It ought to be expressly stated that these last operations made on calves Nos. 6 and 8 at Lamb's Conduit Street Animal Vaccine Station, were made under a perfect sense of need for avoiding any possible accidental contamination. The cleanliness of the calf table, the absolute sterility of the instruments used, the isolation of calf No. 8, and the cleanliness of the operator's hands were therefore rigorously secured.

used for the scraping and vaccination, were previously thoroughly sterilized. Dr. Cory also, previously to receiving the charged lancet and performing the operation, had thoroughly cleansed his hands.

The result of the operation on this infant's arm, when inspected on the eighth day (June 27th), was unmistakable vaccinia, as is shown in Plate XVII. The vesicles were especially satisfactory; indeed the mother of the child said that, though she had for some years brought annually an infant to the station, none of her previous children had presented a finer arm. Dr. Cory kept this child under observation during the whole course of the process, till July 14th, when a scab from one of the insertions was obtained. At no time was there anything abnormal to be noticed in the child; the case exhibited in all respects a process of ordinary vaccinia.

Before proceeding further in description of my procedures, I wish to refer to the following facts. When I was giving evidence before the Royal Commission on Vaccination on March 22nd, 1893, Professor Michael Foster suggested that the positive result quâ vaccinia obtained through calf No. 8 at Lamb's Conduit Street Station was rather sudden, and that the presence of vaccinia at the animal vaccine establishment where calf No. 8 was operated on, may have had to do with the result in question. But against such suggestion I must insist (1) that it is not a fact that in calf No. 8 there was any sudden modification of the locally induced malady. Calf No. 6 as a matter of fact showed as complete results in this sense as calf No. 8; and (2), neither in calf No. 6 nor in calf No. 8 was there any appearance of vesicle at the insertions. Had calf No. 8 shown in any one of the successful insertions a sudden appearance of vesicle, I should be prepared to allow perhaps some ground for such suggestion; though I maintain, so far as the actual operation was concerned, that having regard to the scrupulous care and precaution against accidental infection with vaccinia that was exercised, the conditions under which calf No. 8 was inoculated did not differ materially from those which obtained in the case of calf No. 6. One other point must be insisted upon, which is this: There seems to be a widespread idea abroad,—and it found expression in some of the questions asked of me by the Commission,—that when transferring matter from the eruption on the teats or udder of casual cowpox to calves, the usual result is typical vesicular vaccinia. This is not my experience. My experience is that when transferring lymph from the vesicle of the milker's eruption to a calf, the result as a rule is a typical vesicle in this calf so dealt with; but that when transfer is made to the calf of matter directly taken from the cowpox in the cow, the result though positive is not in fifty per cent. of attempts a vesicle; commonly the insertion becomes indeed raised and surrounded by areola, and the scab which appears in the line of incisions gradually broadens and thickens; but there is no vesicle formed. On a second or perhaps as late as a third transmission from calf to calf of casual cowpox from the cow, some or all of the insertions may become typically vesicular; but it is quite a mistake to suppose that this result is generally produced at the original transfer to the calf of matter from the cow. Thus there is parallelism between the results obtained on the calf with lymph of human variola, and the results of direct transmission to the calf of cowpox matter from the cow; and, as will presently appear, there is parallelism also between the results of transference to the calf of lymph taken from the milker's vesicle (contracted by direct infection from casual cowpox), and the results now to be referred to as obtained by transferring into the calf a crust from the vesicles produced in child L—— by insertion of scraping from the incisions of calf No. 8.

Retrovaccination with lymph of variolous pedigree.

The scab obtained from one of the vesicles of the above child's arm on July 14th (that is at a time when the process was practically in the last phase of healing, the scab having fallen off on July 14th spontaneously), was mashed up in sterile salt solution on July 15th, and this material at once used for inoculation (retrovaccination) at the Brown Institution of

calf No. 16. In this calf, 32 of the 65 cutaneous incisions into which the matter had been inserted were successes. In each linear incision one, two, or three round typical umbilicated vesicles developed on the fifth or sixth day, and these went through the characteristic phases of vaccinia. With lymph of the vesicles of this calf (No. 16) on the sixth day, *i.e.*, July 20th, two further calves were vaccinated at the Brown Institution; and the result was again vaccinia such as is obtained under ordinary conditions at the Animal Vaccine Station. Plate XVIII. shows the result on one of these last-mentioned calves.*

Points charged on 5th day with lymph from calf No. 16, were used by Dr. Cory for vaccination of the arms of two infants at St. Thomas's Hospital. Plate XIX. shows a condition typical of vaccinia in one of these infants on the eighth day. The other infant presented exactly the same condition of typical vaccinia.

Lymph was taken in due course from a vesicle of one of these infants and transferred to the arms of other infants, with the result of producing in them also typical vaccinia. These and the previous infants were kept under observation for some weeks, but in none of them was there anything abnormal observed, either as regards the nature or the course of the eruption.

As a last series of experiments it has to be mentioned that calf No. 16 as well as the two calves vaccinated therefrom, were subjected, after the first eruption had quite passed off (viz. after lapse of six weeks), to revaccination in over 30 cutaneous incisions with the current lymph at the Animal Vaccine Establishment. The result was in each instance total failure.

It would have been no doubt an important final experiment if all the infants, both of the Simpson series as also of the series just dealt with, could have been subjected also to revaccination. But any one who has experience of the unwillingness of mothers to submit their infants to further repeated vaccination will understand our failure to induce the mothers in question to bring back their children, after the first vaccination had to their satisfaction been happily got over, in order for them to be submitted again to a further operation.

III.—Observations on Micro-organisms in Lymph of Vaccinia and Variola.

Bacterio-scopic examination of lymph.

The observations that have been made by a host of bacteriologists on the occurrence of micro-organisms in vaccine lymph, are so abundant that I am not called on to give here a complete account of them; the less since the results of these observations, so far as concerns the discovery of the active contagium of normal vaccine lymph, have been notoriously of an entirely negative character. True, at various times micro-organisms have been isolated and described which were regarded by their discoverers as the active contagium; but again and again on further investigation this has been found not to be the case.

As representative of the class of work in question I limit myself to reference to the observations of Siegel (Deutsche Med. Woch., 1893, N. 2, p. 29) and L. Pfeiffer.

The former on injecting vaccine lymph into the peritoneal cavity of a calf produced nodular excrescences on the omentum of this animal, which on cultivation yielded cocci. These cocci inoculated into the skin of calves produced pustules which in no way are comparable to the

* Unfortunately this calf was restive during the taking of the photograph, and therefore the position is not a good one; the vesicles are blurred, but in reality the appearances in the calf were quite as good as was shown in Plate XIII. (a).

vaccine process. So too L. Pfeiffer, who in various publications and
ticularly in his Monograph (Die Protozoen als Krankheitserreger,
1890) describes protozoa and zoospores as found by him within the
(as in all other vesicular eruptions in man and other animals), i
substance of as well as between the epithelial cells. But on inspect
his drawings it appears to any one acquainted with pathological hist
that the bodies described by Pfeiffer are nuclei, parts of nuclei, or
or less altered nuclei of the epithelial cells. And further Pfe
methods are not such as commend themselves in the least to the m
histologist; still less to the micropathologist. No proper staini
preserving methods were adopted by him, the fresh tissue crushed
broken was alone subjected to microscopic examination.

We may take it then that hitherto neither the contagium of vac
nor of variola, has been isolated; that neither the one nor the
is identifiable with any species of torula, of coccus, or of bacillu
has as yet been described as occurring in one and another sam
the two sorts of lymph.

Now, in considering the question of the nature of the va
contagium, there is a circumstance which stands out very conspicu
amongst the large number of observations made on vaccine lympl
is, that this matter, when thoroughly dried immediately after coll
from the vesicle, preserves its efficacy for a very long time, and pres
it, too, as well or better than lymph stored in the fluid state in cap
tubes. Judging of this fact in the light of what is known
different behaviour under "drying" of spore-bearing and non-s
bearing micro-organisms, the suggestion arises that active vaccine n
contains the contagium of vaccinia in the form of *spores*; for non-s
bearing bacteria are rarely if ever found capable of retaining their vit
when preserved for a very long time in a thoroughly dry state.
of spores, on the other hand, it is well established that they do,
kept perfectly dry, retain indefinitely their power of germinati
transplantation into suitable soil. Another not less important,
perhaps, less conspicuous consideration in this connexion is, as I
found, that lymph taken from the calf on the fifth, sixth, or sevent
retains its efficacy far better than lymph taken at earlier date; th
such earlier lymph when used directly from calf-to-calf or from ca
arm is fully efficacious. So, too, with reference to human vac
lymph taken on the seventh, eighth, or ninth day preserves its ef
best.

These facts are consistent with the existence of spores in the l
taken at those particular times; and indeed it is obvious that a mi
yielding spores as the last phase in its life history, would be pres
the earlier stages of vaccinia chiefly in a non-sporing form, and th
such form it would withstand the drying process of preservatio
well than would the spores of the matured organism. On this
therefore, the earlier the lymph is taken the less numerously spores
be present, owing to the smaller opportunity for the organism to
attained its sporing phase. On the other hand, in the final stages
vaccine process, though the spores would be present in the va
matter, there would be also present other pyogenic and saprop
microbes, and these sometimes in great abundance. Hence the nu
of spores in a given particle of vaccine matter taken at these
stages of vaccinia would be less, and the lymph therefore less effic
after storing.

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* It is unnecessary to discuss the question whether or not the contagiu
living organism; such a discussion is, in the present state of our knowledge
e iology of infectious diseases, a mere anachronism.

A priori, therefore, there is probability that vaccine lymph taken from the vesicle at a particular date—in the calf, the fifth to the seventh day, in the human subject, the seventh to the ninth day—contains most of the contagium in the state of spores; and further, that though the lymph contains at the earliest phase of the vesicle the active contagium, the latter does not then exist to any large extent in the form of spores. And in so far as this is true, it follows that the earlier we obtain lymph from the nascent vesicle the more likely are we to obtain the hypothetical microbe free from the spores which have been in question.

I started then from these considerations in the search, by our present improved methods of observation, of the hypothetical microbe and of its spores.

And first I would refer in general terms to the appearances presented in microscopic specimens of vaccine lymph in its ascertained most effective condition; that, namely, in calf lymph between the fifth and seventh, in human lymph between the seventh and ninth day. In coverglass specimens of such lymph treated in the usual manner (by drying of a thin film on the coverglass, staining with the usual dyes, and mounting in the usual manner in Canada balsam), there is generally very little to be seen; occasionally a coccus or a diplococcus and a nucleus of a leucocyte. It ought to be remarked, however, that if the lymph is collected carefully,—*e.g.*, the human lymph which is sent out by the Vaccine Department of the Local Government Board, or the clear lymph which oozes out if after the wiping off the superficial scab in the calf the pock is pressed between the vaccine forceps,—very few, if any, of the usually described cocci of vaccine lymph can be discovered; the "cleaner" the manipulation, and the more carefully admixture of the superficial epidermis is excluded, the freer of cocci and other known admixtures will the lymph be found, both on examination in stained coverglass specimens and in cultivation. I have had during the last three or four years considerable experience in this matter, and I am prepared to say, as the result of these numerous experiments, that the more carefully the lymph is collected and the more admixture of extraneous matter is excluded, the less there is in coverglass specimens and in cultures of any of those organisms which are usually described as being present in vaccine lymph.

I proceed now to describe in detail the results of my examination of coverglass specimens of films of vaccine lymph, human and bovine.

A.—*Calf Lymph.*

Films of calf lymph taken as above-mentioned on the fifth and sixth day, are allowed to dry on coverglasses, which are then placed in acetic acid (1 in 2) for 5 minutes. They are then washed in distilled water, dried over the flame, and placed in alcoholic gentian violet. Here they are left for 24 or even 48 hours, after which they are washed in water, dried, and mounted in Canada balsam. In such specimens there are observed unmistakable bacilli distinctly stained. Their number is not very great, but there is not any difficulty in finding one or more in almost every field. They are cylindrical rods of fairly uniform length, single, or occasionally in dumb-bells, about 0·4 to 0·8 m.m. in length, and a third of this measurement in thickness. They are generally thinner at the ends than in the middle, and often include a spherical or slightly oval clear globule. In some samples of lymph the number of these bacilli is very small, in others they are so far abundant that in every field one or more examples

may be met with. If lymph is taken earlier, as for instance on t
day, the number of the bacilli is considerably greater; and if t
be squeezed out of an incipient pock on the third day, the n
bacilli is sometimes so great that the lymph may be considered a p
vation of them. In Figs. 37, 38, and 39, Plate XX., such prepara
shown; they are coverglass specimens of lymph taken from a com
pock 72 hours after vaccination. This same lymph was tested
and produced typical vaccinia in every insertion. Appearances
those seen in the above figures cannot but have an important n
it can hardly be maintained that this lymph taken under all r
precautions would contain by accident a pure cultivation of a p
species of bacillus,—the less if, as will presently be seen, all
at cultivating the bacillus by the different methods in use utterly

Lymph of 72 hours, taken under the above precautions, alwa
coverglass specimens, which, when treated after the above
reveal a good many of these bacilli. The appearances in so
of these preparations are so uniform that one is not surprised
being regarded by bacteriologists, unaware of their source, as c
specimens in each instance of a pure (artificial) cultivation of
that is, as coverglass specimens prepared not from an anima
but from an artificial culture. As the above figures indic
bacilli of 72-hours' lymph are always chiefly in groups; the
of groups consisting of a small number (3–8), other groups c
of a considerable number of bacilli. As already stated, the bacil
include clear globules. When viewing them under a ma
power of 1,000 (Figs. 37, 38, and 39), it appears as if som
longer bacilli included two globules; but on higher magnificatio
Fig. 40, Plate XXI.) it is ascertained that in reality each bacillus
only one such globule; that is to say, that where, under th
power, a bacillus appears to contain two globules, this is due
fact that the apparently single bacillus consists in reality of a
two bacilli. This is well shown in Fig. 10, Plate XXI.

Lymph 96 hours old shows the same bacilli, but not in such ab
as in 72 hours' lymph; and the later the lymph is taken
numerous are they found. The explanation of this is, I think,
to seek; for the globules mentioned above correspond to spores
would, therefore, be natural that the later the lymph is taken
there is left of the bacilli, and the more the spores have becor
Unless, however, these spores are seen within the bacilli thems
is not easy, for obvious reasons, to recognise them in stained sp
of lymph for what they are. By staining coverglass specim
lymph taken 100–120 hours after vaccination in the manner u
showing spores (heating in fuchsin), stained granules are brough
the lymph, but it is in these circumstances impossible to identif
as the spores in question; whereas, so long as they or many o
are still contained in the bacilli,—*e.g.*, in lymph 72–96 hours
their recognition is, owing to the presence of the stained bacilli,
And they can be detected even in lymph 100–120 hours old, whe
and there a bacillus or its sheath is still recognisable; but, as
above, the bacilli containing spores are more conspicuous in ly
earlier date, namely, 72–96 hours old.

It is, then, seen that these observations are in complete h
with the postulate that was formulated above, viz., that "ripe"
contains the contagium in the form of spores, while "early"
contains the bacillus in the phase antecedent to that in which
appear in it.

Innumerable attempts have been made by me to cultivate these bacilli in artificial media, but they have all failed. Lymph was cultivated on and in gelatine at 20° and 37° C., on agar at 37° C., on glycerine agar at 37° C., aerobically and anaerobically, but without avail. The very same lymph which contained the bacilli most abundantly (72 hours' lymph), and of which representations have been given in Figs. 37, 38, 39, and 40, when inoculated into artificial media, produced in two agar tubes a few colonies of cocci only; in the majority of tubes (eight) no colonies whatever appeared. It follows then that the above bacilli are at present not cultivable by the ordinary methods. This, though disappointing, is nevertheless of some value, as it proves conclusively that these bacilli, though constant in the lymph, do not belong to the saprophytes that are occasionally superadded to lymph, and that are easily cultivable.

I have tried to overcome the above difficulty by seeking to cultivate the bacilli in the subcutaneous tissue of the calf, and in the following manner. Large quantities of calf lymph (taken fifth–sixth day) were injected into the subcutaneous tissue of the calf's groin, care being taken not to allow any of the lymph to pass into the corium itself. This is easily achieved by contriving that the Pravaz syringe containing the lymph for injection shall have its needle filled with salt solution. The needle having been introduced through the corium, and then thrust horizontally for some distance along the subcutaneous tissue, the piston is next pressed and the contents discharged. The syringe is then again charged, a fresh needle put on, and the injection is repeated in a new locality of the same calf. I have in this manner injected considerable amounts of lymph into the subcutaneous tissue of a calf, in eight different spots of the groin. No cutaneous manifestations took place in this calf. On the eighth day the calf was killed and the subcutaneous tissue of the groin was carefully examined. On exposing the subcutaneous tissue in the region of the injection, it was found very moist and œdematous, and in several places the site of the inoculation was marked by fibrous corded thickenings, some larger, others smaller. An incision into these showed dense tough fibrous tissue, but considerable quantities of serum oozed out of the peripheral portion of each thickening. The nearest inguinal glands were very swollen and on section juicy, much serum oozing out of their cut surface. Coverglass specimens and cultivations were made of the fibrous thickenings and of the œdematous portion of the subcutaneous tissue, as also of the lymph gland. In these coverglass specimens there were found no bacilli, but abundance of cocci, singly, and as diplococci, and as small and large masses. On inoculating nutrient media with the material numerous colonies came up; but they were colonies of the ordinary staphylococcus pyogenes aureus and albus, the relative proportion between the two species being a little in favour of the latter. I then inoculated another calf subcutaneously with the cultures of these two species; on one side of the groin the injection being made with the staphylococcus aureus, on the other with the staphylococcus albus. All the injections took effect, inasmuch as a nodule appeared in the subcutaneous tissue at the seat of each inoculation, the skin above being red. These nodules increased in size for some days; but by the sixth day began to diminish and to become firmer, the skin itself again becoming pale. When attempting to express matters from the nodules on the third and fourth days, pus was obtained, which in coverglass specimens and in culture showed the presence of an abundance of cocci, staphylococcus aureus and albus.

It follows then from all this that the characteristic bacilli described above as being present in considerable numbers in the early lymph,—

practically in pure culture there,—are not cultivable in artificia and are not cultivable in the subcutaneous tissue of the calf.

B.—*Human Vaccine Lymph.*

I have so far only examined human lymph taken on the eigl This lymph was obtained through the Vaccine Department Local Government Board, and was labelled "clear lymph;" that of the very best quality. In coverglass specimens of such prepared in the manner described above, the same minute bac found as in calf lymph; but in limited numbers, just as lymph of the 5–7 day. Some of the bacilli of the human contained in a middle thickened part the clear oval globule m above as probably of the nature of a spore. But there wer present which were cylindrical, and in size and aspect of t character as in the calf lymph. In several examples of lymph the number of these was considerable, and there difficulty in demonstrating them in some samples in almost every fi microscope. In other samples they could be found only here an while free globules that appeared like spores could be always fou cultivations made of this human lymph in the ordinary media p no colonies at all, or only a few colonies of cocci. In no instan colonies of any bacillus obtained.

C.—*Variolous lymph.*

Two samples of variolous lymph were obtained from the ve confluent smallpox. The eruption was at its fourth day. The ly clear, but under the microscope contained a few leucocytes. Cult made from both samples of lymph remained perfectly sterile; in tubes not a single colony appeared. But on preparing co specimens after the above-mentioned method, the same bacilli wer in this small-pox lymph as have been described as occurring in lymph: the bacilli in size, aspect, and in the circumstances that them contained clear globules, were exactly the same. In each fiel microscope a few of these bacilli could be demonstrated. Fig. 4 XXI., shows the bacilli in the sample of small-pox lymph wh used for the successful inoculation of calf No. 2. in Series II experiments with variolous lymph.

Alike then in variolous lymph and in vaccine lymph,—and w the latter be derived from the calf or from the human subject,— the same definite bacillus is demonstrable; a bacillus, namely contains bodies comparable with spores, but which cannot at pr cultivated in artificial nutritive media. It is hardly probable th bacilli are mere accidental admixtures, seeing that they were four samples of lymph, even in those in which none of the not adventitious microbes of lymph could be demonstrated either by co specimens or by culture. That this bacillus is not of the natu superadded saprophyte is also shown by the fact that, wher saprophytes of vaccine lymph are easily cultivable in the c artificial media, the bacillus in question utterly failed to grow i under the most varied conditions of cultivation.

PLATE XIIIA

ETIOLOGY OF VACCINIA AND VARIOLA.

PLATE XIII. (*a*).

Reproduced from a photograph of the abdomen of Calf No. 24, taken on the *sixth day* of vaccination by multiple linear incisions with lymph obtained from Calf No. 22*a* (page 392).

ETIOLOGY OF VACCINIA AND VARIOLA.

PLATE XIII. (*b*).

Represents the vesicles of Calf No. 24 at the date when the photograph reproduced as Plate XIII. (*a*) was taken (see page 392).

Plate XIII (b)

ETIOLOGY OF VACCINIA AND VARIOLA.

PLATE XIV. (*a*).

Reproduced from a photograph of the arm of an infant on the *eighth day* of vaccination, the source of the lymph employed having been Calf No. 22 (*a*) (page 392).

ETIOLOGY OF VACCINIA AND VARIOLA.

PLATE XIV. (*b*).

Drawing of the vesicles, on the eighth day, of the infant referred to under Plate XIV. (*a*) (page 392).

Plate XIV (b)

PLATE XVa.

ETIOLOGY OF VACCINIA AND VARIOLA.

PLATE XV. (*a*).

Reproduced from a photograph of the arm of another infant on the *eighth day* of vaccination with lymph from Calf No. 22 (*a*) (page 392).

ETIOLOGY OF VACCINIA AND VARIOLA.

PLATE XV. (*b*).

Drawing of the vesicles, on the eighth day, of the infant referred to under Plate XV. (*a*) (page 392).

Plate XV(b

PLATE XVI.

ETIOLOGY OF VACCINIA AND VARIOLA.

PLATE XVI.

Reproduced from a photograph of the arm of an infant on the *eighth day* of vaccination with lymph derived from the vesicles of the child referred to under Plates XV. (*a.*) and XV. (*b.*) (page 392).

ETIOLOGY OF VACCINIA AND VARIOLA.

PLATE XVII.

Reproduced from a photograph of the arm of an infant on the *ei*
day of vaccinia; the source of the lymph employed having been
Calf No. 8 (page 394).

PLATE XVII.

PLATE XVIII.

ETIOLOGY OF VACCINIA AND VARIOLA.

PLATE XVIII.

Reproduced from a photograph of the abdomen of a calf on the *sixth day* of vaccination by multiple linear incisions with lymph from calf No. 16 (page 395).

ETIOLOGY OF VACCINIA AND VARIOLA.

PLATE XIX.

Reproduced from a photograph of the arm of an infant on the *eighth* day of vaccination with lymph from Calf No. 16 (page 395).

PLATE XIX.

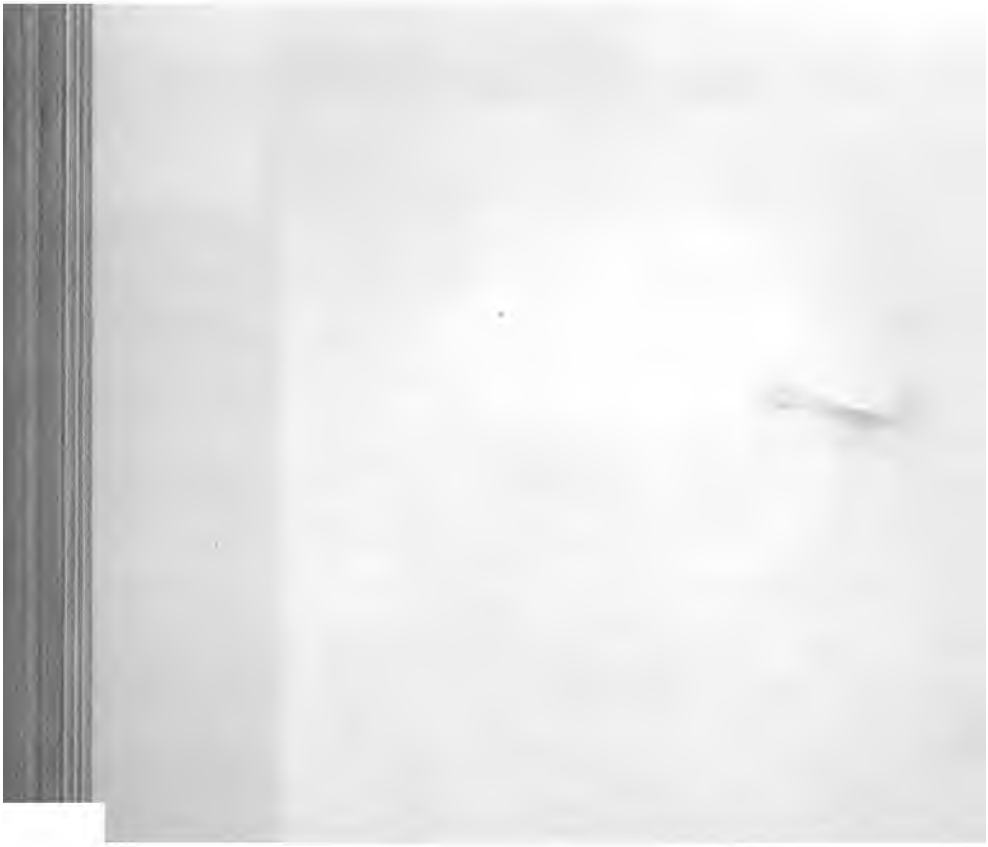


PLATE XX.

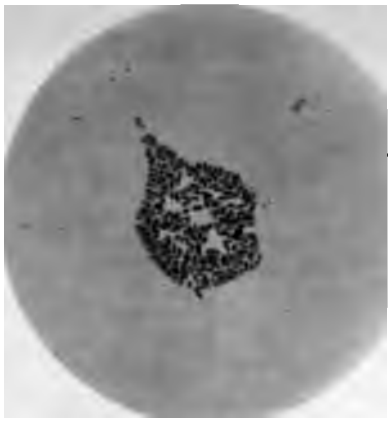


FIG. 37.

FIG. 38.

FIG. 39.

ETIOLOGY OF VACCINIA AND VARIOLA.

PLATE XX.

Figs. 37, 38, and 39.

Reproduced from photographs of cover-glass specimens of *lymph* taken directly from vesicles on calves at the Animal Vaccine Establishment 72 *hours* after those animals had been vaccinated in ordinary course (page 398).

[Magnifying power, 1,000.]

ETIOLOGY OF VACCINIA AND VARIOLA.

PLATE XXI.

FIG. 40.

Represents a cover-glass specimen of *calf lymph* taken under similar conditions to those referred to in regard of Plate XX.

[Magnifying power, 2,000.]

FIG. 41.

Reproduced from a photograph of a cover-glass specimen of clear *lymph* taken on the *fourth day of the eruption* from the *small-pox vesicles* of an unvaccinated patient. The specimen exhibits a few nuclei and a considerable number of minute bacilli (page 400).

[Magnifying power, 1,000.]

PLATE XXI.

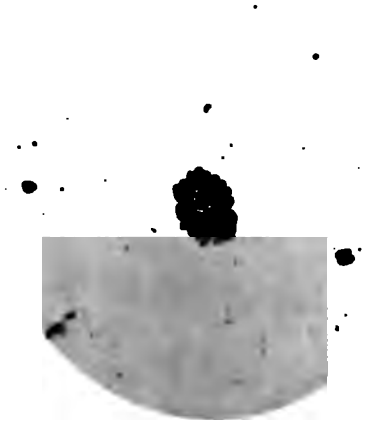


FIG. 40.

FIG. 41.

No. 4.

Report on Micro-organisms found in the Small Intestine of Man; by Dr. Cautley.

By far the most common organism found *post mortem* in the human small intestine is one which has received the name "bacillus coli communis." It is also one of very great interest, and perhaps of greater importance and influence than at present appears. It is almost certainly present in considerable numbers in all human fæces and also in those of a great many lower animals; consequently its range of distribution must be very great indeed. Then, too, it is one of those organisms which grow luxuriantly on all the nutrient media employed in the laboratory, both at the ordinary temperature and at that of the human body; most profusely certainly at the higher temperature. Its multiplication is therefore infinite. Further, it exerts a decomposing action on albumen, as is indicated by the indol found in broth cultivations of the organism. Finally, it possesses exceptional interest, and probably importance, on account of its close resemblance to the organism which has been credited with the causation of typhoid fever. In its cultural characters it is so closely allied to this latter organism in many respects that it has been suggested that they are identical, or merely different phases of the same organism. Hence the need that the properties and characters of bacillus coli communis should be thoroughly investigated.

Method of obtaining this Bacillus.—The bodies of patients who had died from some acute disease, such as meningitis, cholera, cerebral abscess, and the like, or from some prolonged wasting disease, such as sarcoma of the lung and diabetes, were selected for examination, and material was taken from them at periods ranging from 12 to 36 hours after death. A portion of the lower part of the ileum, about two inches long, was in each instance ligatured at both ends and removed from the body. The ligatured intestine was next opened with sterilized scissors, and salt tubes were inoculated with a trace of the contents taken from the surface of the mucous membrane. From the salt tubes gelatin and agar-agar plate-cultures were made. The former were incubated at ordinary temperature, the latter at 37° C.

Results.—In every case this common intestinal micro-organism, the bacillus coli communis, was present in the bowel contents in large number. In some cases it was obtained in pure culture, but more frequently other organisms were also found in the plate cultivations; never, however, more than a few colonies of any individual variety. Some of these other organisms were moulds, various kinds of sarcinæ, and varieties of staphylococci.

The following examples may be given in illustration:—

1. *Tubercular Meningitis* in a girl aged nine. The cultures yielded the bacillus coli in large number, and a few colonies of a liquefying bacillus.

2. *Cholera* in an adult male. The cultures yielded the bacillus coli in large number, and several liquefying colonies of the cholera vibrio.

3. *Cerebral Abscess* in a woman of 39. The cultures yielded a moderate number of colonies of the bacillus coli, and a considerable number of other organisms. Among the latter were two varieties of moulds, and a staphylococcus forming a delicate buff-coloured growth on gelatine and a thick white growth on agar-agar; a sarcina forming a pale yellow streak on gelatine, which it slowly liquefied, and a thick yellowish white growth on agar-agar, with thick deposit in the water of condensation; a sarcina forming a narrow raised nodular growth on gelatine, which it did not liquefy, and a thick pale yellow growth on agar-agar.

4. *Meningitis*, secondary to ear disease, yielded pure cultures of bacillus coli.

5. *Sarcoma of Lung.* About 95 per cent. of the colonies in the plate cultures consisted of bacillus coli. In addition a few moulds and staphylococci were obtained.

6. *Cerebral Hæmorrhage.* Almost a pure culture of bacillus coli was obtained, as well as colonies of a liquefying organism not fatal to mice.

These few examples are sufficient to indicate the overwhelming preponderance of bacillus coli over the other organisms which are at times present in the small intestine. It is worthy of note that even in the case of cholera there was a very large number of colonies of bacillus coli and a very few of the cholera vibrio.

Comparative Observations.—In 1885 Emmerich obtained a bacillus, known as Emmerich's bacillus or B. neapolitanus, from the fæculent dejecta of cholera patients at Naples. In 1886 Weisser found a similar bacillus in normal and abnormal human fæces. Since then it has been shown to be constantly present in fæces of healthy men and children, and in the fæces also of many of the lower animals. Sternberg found it in the blood and various organs of cases of yellow fever. The bacillus cavicida of Brieger is also probably identical with bacillus coli, as also the various bacilli described by Booker as being present in the alimentary canal.

Certain variations have been noticed in the behaviour of this bacillus, both as regards its growth in culture media and its pathogenic power. Thus Brieger's bacillus, obtained from human fæces, was very pathogenic for guinea-pigs. These were invariably killed, within 72 hours, by a small dose of a pure culture injected subcutaneously; a general septicæmic infection being produced. The above variations are, however, neither sufficiently great nor constant to warrant the different samples of bacillus coli being classified separately.

General Characteristics in various Culture Media of Bacillus Coli Communis, obtained from the Bodies of Persons dying of different Diseases.

Gelatin Plate Cultures.—The colonies of this bacillus grow on the surface and in the depth of the gelatine at a rate which varies slightly, but as a rule they are distinctly visible by the aid of a magnifying glass in 24 hours. Their appearance varies somewhat with their age. Those *in the depth* form small spherical or oval colonies, white in reflected light; by transmitted light dark brown, the colour deepening with age.

On *the surface* they form a bluish-white expansion with thinner clearer marginal portions, and irregular edges. By transmitted light the colour of the expanded portion varies from pale straw to dark brown, and shades off towards the periphery. In the centre of each growth is a small round dot like a spherical nucleus, raised and projecting above the surface. This dot or nucleus is oval or horse-shoe shaped, and appears to consist of a body composed of a cortex and medulla, having a light brown central portion and a thick dark brown or almost black ring round it. The horse-shoe shape of the nucleus appears to be due to rupture of the cortex and extrusion of the medulla at the point of rupture. These cultures of the bacillus have a peculiar odour, somewhat like that of a field of white clover.

Gelatin Streak Cultures grow rapidly and form a whitish expanded growth, denser and whiter along the line of inoculation than at the edges, thinner and translucent at the margin. They are iridescent, and their edges are irregular. The growth becomes thicker and whiter with age. The rate of growth, and also the degree of extension over the surface of the gelatin, varies in different cases; as a rule the extension is up to the very limit of the gelatin.

Gelatin Stab Cultures show in 24 hours a large number of minute round colonies along the line of inoculation; with a thin clear extension on the surface, like the flat head of a nail but with irregular edges. This surface growth varies in extent and thickness; sometimes it is quite thin and reaches to the edges of the gelatin, sometimes it is thick and its extension is limited, the top remaining flat.

Gelatin Shake Cultures.—A large number of gas bubbles are formed in 24 to 48 hours, giving the gelatin a characteristic appearance. These bubbles disappear slowly, frequently some are still present in the depth at the end of a fortnight or more.

Sugar Gelatin Stab Cultures grow in the same way as the ordinary gelatin stab cultures, with the exception that the growth on the surface is less marked, being both thinner and less extensive.

On Agar-agar at 37° C. a very profuse thick raised soft white growth is formed in 24 hours. This is flat on the surface, with edges well defined and a little irregular. A thick deposit also forms in the water of condensation within the test tube. There is further a conspicuous development of gas bubbles in 24 hours in the lower part of the tube.

On Glycerin-Agar at 37° C. there is a similar growth in 24 hours to that on agar-agar; but it is rather less profuse, and there is rather less deposit in the condensation fluid. Fewer gas bubbles are formed. This difference in the development of gas bubbles is however practically unimportant, for on making shake cultures of the two media both are almost equally crowded with gas bubbles at the end of 24 hours.

Alkaline Beef Broth inoculated and incubated at 37° C. becomes cloudy throughout in 24 hours, and a considerable deposit collects in the course of a few days at the bottom of the tube.

On Potato at 37° C. the organism grows slowly, and forms a yellowish smooth shiny film on the surface, which becomes brown with age. The growth varies a little in different culture tubes. The broth cultures give a very marked pink indol reaction with nitric acid; the older the culture, the more marked is this reaction.

Milk Cultures are completely coagulated in 24 to 48 hours, and the milk becomes acid.

Gelatin Streak Cultures made on gelatin containing 5 per cent. of *lactose* and coloured with *neutral litmus* gradually but very slowly become faintly blue, indicating an increased development of alkalinity.

Morphology.

In fresh preparations these bacilli are distinctly but not very actively mobile. Their mobility varies with the age of the culture; it is most marked at the end of 24 hours, and gets less and less as the culture grows older. Examination of stained cover-glass specimens shows that the bacillus varies considerably in its morphology both according to the culture media employed and also according to the source from which the organism has been obtained. The typical form is short rod with rounded end; frequently these very short rods are so placed end to end that they look like diplococci.

Preparations from some of the growths show chains and long threads, and also involution forms. The presence or absence and the number and size of these varies considerably, according to the media on which the organism was grown and according also to the source from which the bacillus was obtained.

Action of the Bacillus Coli on Food Stuffs.

Albumen.—Sterile tubes of albumen broth inoculated and incubated at 37° C. soon showed a copious growth. No distinct peptonising action was discoverable.

Albumen Broth and Potato.—No conversion of starch into sugar.

Albumen Broth and White of Egg.—The egg became partially eroded.

Albumen Broth and Olive Oil.—No emulsification of the oil took place.

All these cultures gave a marked indol reaction. This was the only noticeable result obtained, although the organism grew freely in all the media, and was allowed to continue growing for more than three months, with and without free access of air.

Comparison between Bacillus Coli and the following Organisms :—*

1. A bacillus obtained from the intestinal mucus of a mouse.
2. A bacillus obtained from the heart-blood of a mouse subcutaneously inoculated with the typhoid fever bacillus.
3. A bacillus obtained from the mesenteric gland of a patient, No. I., who died of typhoid fever.
4. A bacillus obtained from the peritoneal exudation of a guinea-pig inoculated intraperitoneally with the bacillus from the above typhoid fever case.
5. A bacillus from the spleen of typhoid fever case No. II.
6. A bacillus from the mesenteric gland of typhoid fever case No. II.

* These were placed at my disposal by Dr. Klein, who gives account in this volume of the sources whence they were derived, and the methods by which he obtained them.

Taking these seriatim, I found that :—

1. The organism from the intestinal mucus of the mouse was in almost all respects like the bacillus coli. Microscopically it appeared to be a little larger, with greater variation in length and thickness, and forming longer threads. In gelatin plate culture it closely resembles that organism, the only difference noticed being that the colonies on the *surface* appeared denser and thicker, and the colonies in the *depth* of the medium darker brown by transmitted light, than is the case with bacillus coli. Its growth on agar-agar and glycerine-agar was rather less profuse than that of bacillus coli, but it produced even more gas bubbles. The indol reaction in broth cultures of it was, however, less marked. Taking these differences as a whole, they are rather differences in degree than in kind, and indicate, not that the bacillus is another variety, but that it is slightly modified.

2. The bacillus from the heart-blood of the mouse which died after inoculation with the typhoid fever bacillus, resembled organism No. 1 (that from the intestinal mucus) in its mode of growth, and morphologically. Both produced numerous gas bubbles in shake cultures of gelatin, glycerin-agar, and agar-agar. These gas bubbles persisted longer than in similar cultures of bacillus coli. Both organisms, like bacillus coli, coagulated milk in 24 to 48 hours and caused in it an acid reaction.

3. The bacillus from the mesenteric gland of a patient who died of typhoid fever, varied from the above in a good many respects. Its growth in gelatin streak cultures was the same in kind, but more transparent and less profuse. In stab cultures it also grew much less freely, both in the depth and on the surface. In stab cultures in sugar gelatin it grew even less freely and not at all on the surface. In gelatin plate culture it differed markedly from bacillus coli. The colonies did not grow so quickly or so luxuriantly; no central nucleus made its appearance, or only a very minute one. On glycerin-agar and agar-agar there was less surface growth but more deposit in the condensation fluid; no gas bubbles were developed either in streak or in shake cultures. The bacillus also grew less freely in broth, and failed to produce indol, as indicated by the nitric acid reaction. On potato a smooth, shiny, waxy tenacious film was slowly formed. Milk was not coagulated by this bacillus. Morphologically and biologically too it differed in exhibiting much greater and more persistent motility. The bacilli were considerably longer and more rod-like, and more numerous and longer threads were produced than in the case of bacillus coli. The bacillus changed the colour of neutral litmus gelatin cultures, causing them to become blue more rapidly than bacillus coli, although the growth of the organism was less profuse.

The most important of these differences are the absence of coagulation of milk, absence of gas bubbles in shake cultures, absence of indol reaction, the motility, and the size of the bacillus.

4, 5, and 6. The bacillus obtained from the peritoneal exudation of a guinea-pig, inoculated with the bacillus from typhoid case No. I. and that obtained from the spleen and mesenteric gland of typhoid fever case No. II., did not coagulate milk, and resembled in all respects the organism obtained from case No. 1 of typhoid fever.

So far then the most important distinguishing characteristics of the typhoid fever bacillus are the absence of milk-curdling properties, of indol reaction, and of the power of producing gas bubbles.

Conclusions.

There are several organisms, bacilli, obtainable from the alimentary canal in cases of typhoid fever and other diseases. These grow in the various culture media in slightly different ways. The typical typhoid fever bacillus has certain distinctive morphological and cultural characters. The bacillus coli, as generally observed, has also distinctive characters. So far as these investigations are concerned, it would appear that the bacillus coli is not identical with the typhoid fever bacillus, and that one cannot be developed from the other by artificial culture.

No. 5.

Observations on Blood-Infection; by Frederick William Andrewes, M.B., M.R.C.P.

Septicæmia may be broadly defined as the multiplication of micro-organisms within the blood of a living animal. Many organisms, even though pathogenic under other conditions, have not ability to produce septicæmia, but quickly vanish from the blood when injected into the circulation. Or it may happen that an organism has this power in one animal, and not in another less susceptible animal, though in the latter it may still be in other ways pathogenic. Any observed facts bearing on the power of micro-organisms to grow in the living blood may thus be of importance and deserving of record.

The present series of observations was undertaken with species of micro-organisms derived for the most part from cases, human or other, in which blood infection had actually occurred. The following organisms were employed:—

(1.) *Streptococci* of two species; one apparently identical with streptococcus erysipelatos, the other a species derived from a case of cerebral abscess, and so far as I am aware previously undescribed. (2.) *Bacillus typhosus* (of Eberth and Gaffky) and *Bacillus coli communis*. And (3.), two organisms closely allied to the latter, which were found as accidental sources of blood infection in certain experiments on guinea-pigs.

Streptococcus Erysipelatos.

A boy suffering from typhoid fever died of perforation of the bowel. The heart-blood, collected with every precaution after death, showed large numbers of streptococci. These grew abundantly in pure culture in cultivations made from the blood by Dr. Klein, who concluded from the results of experiment on animals (*vide* his paper on the Etiology of Enteric fever in this volume) that the organism was the erysipelas coccus; though in what manner blood infection had arisen in this case of typhoid fever with no erysipelas complication remained unexplained.

Observations were therefore undertaken to ascertain whether blood infection could be produced in rabbits with this organism.

(1.) Two rabbits were inoculated subcutaneously in the groin with an agar-agar culture of the streptococcus which had, the day before, produced in the ordinary way typical erysipelas in two rabbits. One of the rabbits of the new series died on the fourth day. No local erysipelas had been produced, but there was some hæmorrhage at the point of inoculation, and around it some semi-purulent whitish material. Cultivations on gelatin and agar-agar made with material from the subcutaneous tissue at this spot, yielded practically pure growth of the streptococcus; and cultivations made in the same way from the heart blood yielded numerous pure colonies of the same organism. Blood infection had therefore been produced in this case. The second rabbit remained well and was afterwards used for a further experiment (3).

(2.) Two rabbits were anæsthetised with chloroform, and injected within the peritoneum (as was supposed) with the condensation fluid from an agar-agar culture of the coccus from the heart-blood of the preceding rabbit, diluted with sterile salt solution: each received about 1 c.c. of the mixture. One of these rabbits had previously been inoculated subcutaneously with the same streptococcus without any result. It again remained

unaffected. The other rabbit died on the fourth day, when it was found that the injection had not penetrated into the peritoneum, but only into the subcutaneous tissue of the abdominal wall, where there was some purulent exudation. The injection had been made to one side of the middle line, and the skin over the whole of that side of the abdomen and thorax was found intensely congested but not œdematous. There was no peritonitis. The pericardium contained a slight excess of fluid, and a gelatin tube inoculated from this yielded a single colony of the streptococcus. Two gelatin and two agar-agar tubes were inoculated from the heart-blood, and in all a few colonies of the streptococcus arose. Hence a slight degree of blood infection had been produced. Since the injection failed to reach the peritoneum this observation merely confirms the previous one.

(3.) Two rabbits were inoculated subcutaneously in the groin with mixed cultures of the streptococcus and the bacillus typhosus. One of these was the rabbit already referred to as having resisted inoculation with the streptococcus in experiment (1.): this animal again remained well. As regards the other, which died in six days, the point of inoculation was found injected and with a little purulent exudation thereabouts. There was some turbid bloody fluid in the peritoneum, and from this and from the heart-blood cultivations were made on gelatin and on agar-agar. All the cultures remained sterile, hence either no blood infection had been produced, or it had been transitory and had not endured for the longer period which this animal had survived as compared with the others.

From these experiments it results that this streptococcus is, when inoculated subcutaneously, able in certain cases to produce in rabbits blood infection. It had in all probability produced blood infection in the original case of human typhoid fever, and it is a well-known fact that in fatal cases of human erysipelas, an infection of the blood by the erysipelas coccus sometimes occurs.

Streptococcus from a case of cerebral abscess.

A patient suffering from hæmoptysis accompanied by very fœtid expectoration, died with cerebral symptoms. At the autopsy he was found to have bronchiectasis, and in the brain an abscess was discovered occupying the greater part of one frontal lobe, and holding two ounces or more of very thick greenish pus devoid of any odour. Stained cover-glass preparations of the pus showed numerous streptococci in long chains, the cocci being smaller than streptococcus pyogenes. No other organisms could be found. Agar-agar cultures made from the pus and incubated at 37° C. yielded very numerous pure colonies of the streptococcus, no other organisms being present.

The following are the characters of this streptococcus. It grows only at the temperature of the body: gelatin and other cultures incubated at 20° C. showed no sign of growth even after many weeks. On agar-agar and in broth at 37° C it grows well. On agar-agar the colonies are plainly visible in 24 hours; they are circular, semi-translucent and of a greyish white colour. In a few days they become thin and transparent in the centre, and thickened and more opaque at the edges, thus assuming a ring-like or circinate form which is peculiar and characteristic. The colonies rapidly attain their full size, which rarely exceeds that of a pin's head: only when they are very few and widely separated do they grow larger than this, and it is under these latter conditions that the circinate form is best developed. On glycerin agar-agar the colonies become in a week or ten days extremely flat and transparent, so that they are scarcely visible. The cultures do not live very long: in from two to

three weeks they are dead. Streak subcultures on agar-agar were kept up for many generations and maintained the same characters, the colonies in the streak remaining for the most part discrete and showing, when of moderate size, the above-mentioned ring-like form. The condensation fluid from the agar-agar cultures contained the streptococcus in very long chains. Subcultures on gelatin at 20° C. invariably failed to grow.

In broth at 37° C. a white flocculent deposit was present in 24 hours. It always remained scanty, and was composed of very long chains of the streptococcus. The individual cocci in the chains were smaller than those of streptococcus pyogenes. Grown in milk the coccus failed to produce any coagulation.

The above organism thus differs from streptococcus pyogenes not only in its size but in some of its cultural characters, especially in its failure to grow at 20° C. and in the ringed form of the colonies. I have failed to find any description of this species; and I propose provisionally to name it streptococcus circinatus, in allusion to the peculiar form assumed by well-isolated colonies, which distinguishes it from other streptococci with which I am acquainted. It differs also in another respect from streptococcus pyogenes, namely, in its pathogenic power. It is not easy to induce suppuration in rabbits with streptococcus pyogenes, and the inflammation excited is of a diffuse and spreading character. But the streptococcus now described readily produces a circumscribed chronic abscess containing firm whitish caseous material, which eventually becomes absorbed and disappears without liquefying or breaking externally. This was produced indifferently in rabbits and guinea-pigs.

Thus, with a view of testing the physiological effects of this streptococcus, two rabbits were inoculated subcutaneously with a three days' old broth culture, which was a first subculture from the original tubes.

Rabbit 1 received about a quarter of a cubic centimeter of the broth beneath the skin of the ear. In 24 hours there was visible at the point of inoculation a small papule, which in three days had increased to a firm whitish nodule with hardly any redness round it. In a week or ten days it was as large as a small pea, but showed no inflammatory reaction around it. In this condition it remained stationary for many weeks, showing no inclination to soften or break down. In two months it had diminished much in size, and in three months had practically disappeared. The rabbit remained in good general health throughout.

Rabbit 2 was inoculated at the same time with the same broth culture, but received nearly two cubic centimeters of the broth beneath the skin of the groin. In 24 hours it showed a reddened nodule at the point of inoculation as big as a small pea. In three days this nodule had more than doubled in size and there was some inflammatory redness round it. On this day the skin over the nodule was sterilised and, with a capillary pipette, a small white caseous plug was withdrawn from the centre of the swelling. This plug was found to consist mainly of pus cells, with fairly numerous cocci mostly in pairs or short chains of 4–6 elements; the cocci were free and no phagocytosis could be observed. Cultures made on agar-agar from the caseous material yielded pure colonies of the original streptococcus. The abscess in this rabbit continued for a time to increase in size and became irregular in shape as if composed of several agglomerated nodules: but at the end of a week the inflammatory reddening around it had disappeared, and the animal was in good general health. However about the 15th day after inoculation it died rather suddenly and without obvious cause. The local abscess was found

caseous and not softening: the viscera were all healthy, and cultures from the heart-blood remained sterile. No blood infection had therefore occurred.

Two guinea-pigs were next inoculated subcutaneously in the groin, each with a cubic centimeter of a broth culture of the streptococcus; this being the fourth subculture from the original tubes. One guinea-pig remained well, no local effect being produced. It died, however, about five weeks later; no cause for death was found, and the point of inoculation appeared quite healthy. The other guinea-pig developed a local tumour, which after a fortnight was as big as a small hazel nut. This animal died in a month, when the tumour was found to consist of a number of caseous lymphatic glands which had broken down in the centre of the mass into semi-fluid pus. Cultures from this pus, however, yielded numerous colonies of a short bacillus; so that the liquefaction of the caseous material cannot be assumed to have been due to the original streptococcus. Cultures from the heart-blood of this animal remained sterile.

In order to ascertain whether the organism of experiment would grow in the blood, *two rabbits* were inoculated intravenously (into the ear-vein), each with a cubic centimeter of a 3-days old broth culture of the streptococcus. One died in 19 days, and was found to be much wasted, but without any sign of visceral disease or metastatic inflammation anywhere. Cultures from the heart-blood remained sterile. The other died in 28 days, and was found equally free from any visceral abscess.

This streptococcus therefore appears unable to produce blood infection or septicæmia in any form. It is, however, markedly pyogenic, though it differs from most other pyogenic organisms in producing chronic rather than acute abscess.

Bacillus typhosus and Bacillus coli communis.

The cultures employed were derived respectively from the mesenteric glands of a person dead of typhoid fever, and from normal human intestinal contents. The two species are apparently closely allied, and much resemble each other in cultural characters. The main points of difference between them were found, by repeated observation, to be these:—The typhoid fever bacillus is a longer rod, on the average, than bacillus coli, and is further much more actively motile; it has no power of coagulating milk, nor of producing indol when grown in broth. Bacillus coli, on the other hand, coagulates milk in 24 hours at 37° C., and broth cultures of it give a well-marked indol reaction after a few days. (*See also* Dr. Cautley's report in this volume.)

All attempts to produce blood infection with these organisms were unsuccessful, a result not altogether in accord with that of other observers. In rare cases the typhoid bacillus has been found in the heart-blood of fatal cases of human typhoid, and blood infection with bacillus coli has repeatedly been produced in animals. Neither species, however, has been found by me capable of causing a typical septicæmia in the rabbit.

Two rabbits were inoculated into the peritoneal cavity, one with a cubic centimeter of an emulsion of a 7 days old agar-agar culture of bacillus typhosus in sterile salt solution, and the other with a similar emulsion of bacillus coli. Both animals remained perfectly well. This failure to produce peritonitis may, however, have been due to loss of virulence on the part of the organisms which had been cultivated outside the body for some months, or to the fact that the dose injected was too small.

Two rabbits were intravenously inoculated (into the ear-vein), one with a cubic centimeter of an emulsion in sterile salt solution of a 13-days old culture of bacillus typhosus, and the other with the same quantity of an emulsion from a similar culture of bacillus coli. The next day the rabbit injected with bacillus coli seemed a little ill, but this soon passed off. Practically both animals were unaffected. However, the rabbit inoculated with bacillus coli died after 14 days; but beyond general wasting, nothing abnormal was found, and cultures from the heart-blood remained sterile. The other rabbit remained well.

A further experiment was made to ascertain whether blood infection with the living bacillus coli could be produced in a rabbit previously made ill by the inoculation of a considerable quantity of an emulsion of the dead bacillus, *i.e.*, of the protoplasmic or intracellular poison of this organism. An emulsion of the scrapings from the surface of a one-day old agar-agar culture of bacillus coli was accordingly made in beef broth, and two cubic centimeters of this were injected subcutaneously in the groin of a small rabbit,—the emulsion thus injected having been sterilised by exposure for 10 minutes to a temperature of 65° C. The animal was not rendered particularly ill by this proceeding, and next day it was inoculated intravenously with one c.c. of an emulsion in previously boiled salt solution of the scrapings from a two-days' old agar-agar culture of bacillus coli, unsterilised. At the same time a control rabbit was intravenously inoculated with the same quantity of the same unsterilised emulsion. Both animals remained in perfect health.

These six experiments show that it is not easy to produce blood infection in rabbits with bacillus typhosus, or with bacillus coli from the normal human intestine; that it is at least difficult to do this when these organisms have been grown for some time outside the animal body. And this result is interesting, when compared with that obtained in the next series of experiments with closely allied bacilli.

Bacilli of two sorts closely allied to bacillus coli communis.

In Dr. Klein's report will be found an account of a series of experiments in which large doses of micro-organisms of different species (bacillus prodigiosus, bacillus coli, spirillum choleræ asiaticæ, staphylococcus aureus, &c.) were injected intraperitoneally into guinea-pigs; and in which the products of the peritoneal inflammations thus excited were in turn injected into the peritoneal cavities of further series of guinea-pigs. In these experiments blood infection constantly occurred. But it was also found in a given series of animals that, not only was the micro-organism originally injected found in the peritoneal exudation and the heart-blood, but that an intrusive organism—a bacillus closely allied to bacillus coli communis—appeared also in larger numbers in this exudation; and this the more abundantly the further removed in the series was the animal from that originally inoculated. Thus in a series of guinea-pigs inoculated from peritoneum to peritoneum with bacillus prodigiosus, the new organism gradually increased in numbers in the peritoneal exudations and in the heart-blood till it had almost replaced the bacillus prodigiosus. In another series of guinea-pigs similarly treated with staphylococcus pyogenes aureus, a similar but not identical organism appeared in the same way. Both these adventitious species were capable of producing an intense septicæmia in guinea-pigs and mice. It is probable that these adventitious organisms were derived from the intestine, since it is impossible to exclude occasional accidental puncture of the gut in performing intraperitoneal injections; but it is quite likely

that an inflamed peritoneum allowed of the passage into it of micro-organisms from the interior of the intestine.

The two species of bacillus thus obtained were carefully studied and compared with bacillus coli communis and bacillus typhosus. From both of these they presented differences, notably in pathogenic power. I am not able to refer them with certainty to any described species, though the description of Brieger's Bacillus cavicida is not very dissimilar. They may be spoken of provisionally as Bacillus septicæmiæ of the guinea-pig, Nos. 1 and 2.

B. Septicæmia of the guinea-pig No. 1, *i.e.* that found in the peritoneal exudation and heart-blood of a series of guinea-pigs which had been intraperitoneally inoculated with bacillus prodigiosus. This organism is aërobic and does not liquefy gelatin. Grown in beef broth at 37° C., it produces a rapid and uniform turbidity, and after a few days a whitish deposit at the bottom of the tubes. After a week, the broth gives a marked indol reaction, turning a deep red on the addition of nitric acid. The bacilli are actively motile, something between bacillus coli and bacillus typhosus. They do not develop into such long threads as bacillus typhosus; and certainly they are distinctly more uniform than bacillus coli. Grown in milk, strong coagulation is, however, produced in 24 hours in 37° C.

Gelatin plate cultivations of the organism show after two days irregular, semi-transparent superficial colonies, about $\frac{1}{12}$ inch in diameter: in the depth of the gelatin the colonies are small and globular. Streak sub-cultures on gelatin grow rapidly, spreading to a width of $\frac{1}{4}$ inch in 24 hours, and exhibiting a very delicate transparent edge. Eventually the streak becomes half an inch or more in width, and is greyish and semi-translucent. Stab-cultures in gelatin grow well, and some gas bubbles appear in the medium. The bacilli when grown on gelatin are much shorter than bacillus typhosus, and in this medium closely resemble bacillus coli. In gelatin shake culture they form gas bubbles abundantly.

On agar-agar, at 37°, growth is rapid, a thick whitish layer being formed quite like that of bacillus coli or bacillus typhosus. On potato the growth is thin, white, and glutinous, not very easy to see.

This bacillus thus resembles bacillus coli in its important cultural characters, gelatin and agar-agar cultures being impossible to distinguish from those of B. coli; it resembles it also in yielding indol, in forming gas bubbles, and in coagulating milk. It differs from it in the fact that the bacilli, grown in broth, are longer, larger, and much more actively motile (B. coli, in fact, shows under this condition hardly any motility at all). It differs also markedly in its pathogenic power.

Two guinea-pigs were inoculated subcutaneously in the groin with the peritoneal fluid of one of the last guinea-pigs in Dr. Klein's bacillus prodigiosus series (which had been inoculated intraperitoneally with the peritoneal exudation of a previous member of the series). They died in about 36 hours, and each presented hæmorrhagic œdema over the skin of the belly, and, as well, intense peritonitis. Cultures from the heart-blood, the subcutaneous œdema fluid, and the peritoneal exudation all yielded, in both animals, pure colonies of the bacillus septicæmiæ of the guinea-pig No. 1. No single colony of bacillus prodigiosus appeared in these cultures. The leucocytes of the peritoneal fluid were crowded with the septicæmic bacilli.

With the condensation fluid from agar-agar cultures derived from one of the above animals two fresh guinea-pigs were subcutaneously inoculated in the groin, each receiving a quarter of a c.c. of the fluid. One

animal was found dying in 24 hours, and was killed with chloroform. At the seat of inoculation was a large subcutaneous tumour as big as the last joint of a man's thumb, partly purulent and partly hæmorrhagic, and there was much œdema reaching up the side of the belly. The œdema fluid swarmed with the septicæmic bacilli. There was peritonitis with flaky lymph about the liver, and in the peritoneum scanty turbid exudation containing crowds of bacilli, which also were abundant within the leucocytes. The spleen and supra-renals were enlarged, but the other viscera appeared normal. Cultures on gelatin and agar-agar gave the following results: The œdema fluid round the seat of inoculation yielded mainly colonies of the bacillus (No. 1) which had been injected, but also some contaminating colonies of an organism liquefying gelatin. The peritoneal exudation yielded pure colonies of the septicæmia bacillus No. 1. The heart-blood yielded the same bacillus in pure culture.

The second guinea-pig died in 36 hours, and showed similar post-mortem appearances. Cultures on gelatin and agar yielded results as in the first case, except that those made from the peritoneal fluid were not quite pure.

Two fresh guinea-pigs were inoculated subcutaneously with minute doses of the bacillus; they became somewhat ill, and died in five days. Both showed the same post-mortem appearances. There was much local infiltration, bloody and semi-purulent, at the seat of inoculation, extending over most of the skin of the abdomen; and in the groin of each, where the injection had been made, there was a tumour as big as a hazel nut. No peritonitis occurred in either, but there was some turbid gelatinous fluid in the pericardium. The spleen was enlarged, dark, and soft, and contained some whitish granules. The heart-blood of each yielded, on culture, profuse and abundant growth of the septicæmia bacillus, No. 1, and the same was the case with the peritoneal fluid. The œdema fluid from the skin yielded in one instance pure colonies of the bacillus, in the other a few contaminating colonies were present.

Two mice were inoculated subcutaneously in the back with half a c.c. of a two-days' broth culture of the septicæmia bacillus No. 1. Both died in less than 24 hours; one had no local changes at the seat of injection, the other had a little dryish suppuration. Cultures made from the heart-blood yielded in each case numerous pure colonies of the bacillus.

Bacillus septicæmiæ of the guinea-pig No. 2.—Found in the peritoneal exudation and heart-blood of guinea-pigs which had been intraperitoneally inoculated with staphylococcus pyogenes aureus. This bacillus is aërobic and does not liquefy gelatin. Grown in broth it produces a uniform turbidity with a white deposit: no indol re-action is produced. The bacilli are smaller and shorter than bacillus typhosus and bacillus septicæmiæ of the guinea-pig No. 1, and resemble in size and form bacillus coli.; they are however very actively motile. Grown in milk at 37° C., no coagulation is produced; this was found to be constant, the experiment being repeated on several different occasions. In gelatin shake culture this organism forms gas bubbles abundantly.

On gelatin and on agar-agar the growth of this bacillus closely resembled that of bacillus coli, bacillus typhosus, and bacillus septicæmiæ of the guinea-pig No. 1; so that no distinguishing characters can be given. From bacillus coli and from bacillus septicæmiæ No. 1 it is clearly distinguished by its inability to coagulate milk, and by the absence of indol re-action when it is grown in broth. From bacillus typhosus it

is distinguishable only by its smaller size and very different pathogenic powers.

Two guinea-pigs were inoculated subcutaneously in the groin, each with 1 c.c. of a two-days' old broth culture of this bacillus. Both became ill, and one developed a large local tumour; the latter animal died in four days. In the groin, at the point of inoculation, was a tumour as big as a pigeon's egg, solid, and not suppurating; the skin over it was inflamed, and hœmorrhagic œdema extended for some distance around. There was no peritonitis and the intestines appeared normal. The liver was very pale, and the spleen somewhat enlarged and dark with some whitish granules in it. Cultivations from the local tumour yielded a pure crop of the bacillus septicæmiæ No. 2, and cultures of the heart-blood yielded also numerous pure colonies of the same bacillus.

The other guinea-pig died 24 hours later. There was found some semi-purulent infiltration at the point of inoculation, but no tumour such as was present in its fellow. In other respects the post-mortem appearances in the two corresponded. The cultures made from the heart-blood yielded only very few colonies—two in each tube—of the bacillus septicæmiæ No. 2; no other organisms were present.

Two mice were inoculated beneath the skin of the back, each with half a c.c. of the bacillus. Both died within 24 hours, and showed local œdema at the seat of inoculation. Cultures made from the heart-blood yielded in one case numerous, in the other fewer, colonies of the bacillus. There were in one tube some contaminating colonies, but the large majority were bacillus septicæmiæ No. 2; and, on testing them, these were found not to coagulate milk.

From these observations it results that virulently septicæmic organisms may appear as a secondary infective agency in experiments involving the peritoneum in guinea-pigs, the probable source of the superadded infection being the bowel. The interesting question is therefore opened up as to how far similar processes may occur in cases of abdominal disease in man. There can indeed be no doubt that there exist a number of organisms closely allied to bacillus coli communis, but differing from that organism in certain chemical, physiological, and pathogenic properties, even where the morphological and cultural resemblances are close. The typhoid fever bacillus is one of this group, and in it must also be placed the septicæmia organisms above described. Closer study of such of these organisms as occur in man is much to be desired.

No. 6.

Report on the Chemical Pathology of Diphtheria in relation to the Symptoms of the Disease; by Sidney Martin, M.D., F.R.C.P.

In my last report* I dealt with the chemical pathology of diphtheria and of infective endocarditis, and recorded experiments illustrating the physiological effects of the poisons found in patients dying from these diseases. In the present report I propose to deal with the bearing of these results on our knowledge of the symptoms, more particularly of diphtheria. The investigation of the chemical pathology of diphtheria resulted in the demonstration of the following points:—

1. That the bacillus diphtheriæ (the "Klebs-Loeffler" bacillus) is the prime cause of the disease, and produces its effects, not by entering the body, but by the formation of a fibrinous membrane in which it liberates a toxic agent, a ferment which enters the blood-stream.
2. This ferment (called also the secondary infective agent) digests the proteids of the body, chiefly in the spleen, and thus forms two kinds of products:—a proteid, of the nature of albumoses, and a non-proteid, an organic acid.
3. Of the products, the albumoses are by far the most active. They are active fever producers; and in multiple doses they cause a progressive paralysis, dependent on a characteristic degeneration of the peripheral nerves. The organic acid is not definitely a fever producer, nor does it produce palsy; it causes however a slight degeneration of the nerves.

The main ground on which these results were based was, that the bacillus diphtheriæ in a suitable artificial culture medium produced the same products with the same physiological action as those found in the bodies of human beings dead of diphtheria.

In proceeding to discuss the relation of these results to the symptoms observed in human diphtheria, the following points will be considered—

1. The nature of the false membrane and its relation to the poisons found in the tissues of diphtheria patients.

2. The evidence of the action of the specific poison in cases of diphtheria.

   α. In the character of the fever produced.

   β. In the action on the respiration.

   γ. In the action on the heart and circulation, and in the mode of death.

   δ. In the mode of onset of the paralysis.

3. The indications of treatment from a consideration of these results.

1. *The nature of the false membrane.*—It is still maintained by many persons, as a reference to the text-books on medicine will show, that the false membrane formed in the throat and larynx in diphtheria is secondary to a general disease. This view, unsupported by any facts and in

* Paper in Report of the Medical Officer of the Local Government Board for 1891–92.

opposition to the clear clinical demonstrations of Trousseau, is quite untenable. The false membrane in diphtheria is the seat of infection, and is the cause of all the symptoms and sequelæ of the disease. This conclusion is based on the following facts:—

(*a.*) The bacillus diphtheriæ is found in the false membrane and in the membrane alone. It does not, in the naturally acquired disease, enter the lymphatic or blood-stream, and does not therefore multiply in the body generally. Indeed, even when this bacillus is injected subcutaneously into animals, its growth is limited to the seat of inoculaton; it does not, like the bacillus anthracis or like septicæmic micro-organisms, enter the blood and multiply in the organs of the body.

(*b.*) The membrane, which consists of fibrin, is demonstrated by the results of chemical analysis to be in a state of partial digestion, *i.e.*, besides the fibrin there are present in it some of the digestive products of proteids, viz., albumoses. These exist, it is true, in very small amount, just sufficient to indicate that digestion of the fibrin is occurring. Pathogenous bacteria, as I have shown, are capable of digesting proteids, and the products of this digestion are the agents which produce the symptoms in infective disorders. The amount of the digestive products in the false membrane is not by itself sufficient to produce the symptoms of diphtheria.

(*c.*) There is, however, in the membrane a chemical poison which produces in small doses all the characteristic symptoms of diphtheria; the fever and the palsy due to nerve degeneration. This poison in a *single* dose will produce effects only to be accomplished by *multiple* doses of the digestive products of the bacillus diphtheriæ or by multiple doses of the albumoses found in the spleen and blood of patients dead of diphtheria. I have considered this poison to be a proteolytic ferment, and to be identical with the poison described by Roux and Yersin as present in cultures of the diphtheria bacillus in peptone broth. The way in which it acts in the disease is, that it is absorbed into the blood-stream and digests the proteids of the body, especially those of the spleen; the products of this digestion, viz., the diphtheria albumoses and the organic acid, being the actual agents by which the symptoms of diphtheria are produced. It is to be clearly understood, however, that this poison existing in the membrane has not been isolated and demonstrated to possess a proteolytic action. All my experiments in this direction have hitherto failed, as also did those performed by Roux and Yersin. But that it is a proteolytic ferment is, I think, a fair deduction from a consideration of the results of the experiments. Pathogenous bacteria digest proteids, *i.e.*, when they are grown in a suitable medium containing fibrin, alkali-albumin, or serum, they transform the contained proteids into digestive products of two classes,—albumoses and certain non-proteid substances. How do they effect this change? Do they take into their substance the proteids as fibrin, alkali-albumin, &c., and excrete them as albumoses and other products; or, do they excrete some agent which transforms the proteids? In deciding such a question as this, one which is intimately associated with the very existence of the bacterium, it must be conceded that proteids are necessary for the active metabolism of pathogenous micro-organisms; the necessity of this food constituting, perhaps, the greatest biological difference between pathogenous and non-pathogenous bacteria. Analogy and experiment would lead to the conclusion that the form in which the bacterium absorbs its proteid food is in the form of albumoses and not of any undigested proteid. Thus pepsin and trypsin transform the proteids in the stomach and small intestines into albumoses which are re-transformed into the proteids of the body during their passage into the lymph or blood-stream. The utility,

apart from any molecular change produced, of the transformation of proteids into albumoses during the process of digestion, appears to be that the digestive products are more soluble, more diffusible, and hence more easily absorbed and manipulated by the mucous membrane. It is probable, therefore, that the pathogenous bacteria perform the same process and absorb their proteid food in the form of albumoses. If this conclusion be correct (and be it remarked such bacteria flourish in peptone broth), they are likely to perform the digestion of proteids, whether in an artificial culture medium or in the tissues of the body, by means of an excretion, *i.e.*, a proteolytic ferment. That ferments can be extracted from the bodies of pathogenous bacteria is known, just as they are extracted from the mucous membrane of the stomach, from the pancreas, from the seeds and fruit of plants, and from certain fungi (*e.g.*, æthalium septicum, one of the myxomycetes). But although ferments may be extracted from bacteria, it does not follow that bacteria excrete them to digest the proteids surrounding them. There is some evidence, from a microscopical examination of the diphtheria membrane, that the bacillus excretes a substance which digests the fibrin. In sections of the membrane in some cases of the disease this is seen to be composed of three layers; the most superficial being the layer containing groups of the bacillus diphtheriæ, the layer beneath this being composed of fine amorphous granules, and the lower layer (that next the mucous membrane) being composed of fibrils of fibrin with leucocytes. The granular layer of the membrane is evidently composed of fibrils of fibrin which have been broken up into granules as in the process of digestion.

To sum up the argument, therefore:—(1) there exists in the diphtheria membrane a substance which in a single dose accomplishes the effects achieved only by multiple doses of the albumoses found in the tissues of the diphtheria patient; the effect of this infinitesimal small dose in its gradual and progressive physiological action simulating the effect of the bacillus itself; (2) the membrane in diphtheria is in a state of digestion, whereas the bacillus grows only near the surface; and (3) the digestive products found in the tissues of diphtheria patients, although possessing the same physiological action as the membrane, act only when administered in larger and in multiple doses, hereby warranting the conclusion that the poison existing in the membrane is a proteolytic ferment, excreted by the bacillus diphtheriæ.

It is thus evident that in the diphtheria membrane there are two infective agents: one a living organism, viz., the bacillus diphtheriæ, and the other a chemical substance; and that it is the latter alone which is absorbed into the tissues of the body. This was clearly shown in my last Report.

It is necessary also to draw attention to another point, viz., the relation of the amount of membrane present in a case of diphtheria to the amount of albumoses and organic acid found in the tissues. It is probable that if a large amount of false membrane is formed consequent on the growth of the bacillus diphtheriæ, that a great deal of the chemical poison of the membrane is likely to be formed, and therefore to be absorbed; and such cases are considered, and rightly so, as very serious. The severity of the disease does not however depend solely on the amount of membrane formed at any period of the disease. It is not infrequently observed clinically that cases with only a moderate amount of membrane in the throat readily controlled by treatment, die nevertheless suddenly. And in this connexion special attention may be drawn to Case 1* (laryngeal

* On page 149 of last year's Report there is an erratum in the Table at the bottom of the page. In Case I. the larynx alone was affected, not the "tonsils," and in Case III. the tonsils were affected.

diphtheria) of last year's Report (p. 148), in which at death there were only a few erosions of the laryngeal mucous membrane, although microscopically a few flakes of membrane with bacilli could be detected. In this case nearly one gramme of albumoses, and over 0·25 gramme of the organic acid, were extracted from the organs, and were found to be the diphtheritic poisons by their producing the nerve degeneration in rodents. The amount of membrane, therefore, is not the sole criterion of the severity of the disease. The other factor which is important is the facility of absorption of the chemical poison. There can be little doubt that the layer of fibrin between the bacilli and the mucous membrane is a barrier, perhaps only a slight one, to the absorption of the proteolytic poison; that in the case just quoted this barrier was practically absent, and that therefore absorption was readily accomplished. It is also probable that absorption of this poison is more easy when the membrane is in the nose or larynx, or when it becomes pultaceous. These last cases of pultaceous membrane are always, in my experience, serious.

One point in connexion with the poisons found in the bodies of diphtheria patients may be mentioned briefly. No one has affirmed that the albumoses found are not really present, but it is suggested that they owe their toxic action to admixture with the more powerful poison absorbed from the membrane. Anyone who impartially reads the experiments recorded in my last Report will see that this proposition is quite untenable; and the reasons may be again briefly stated. The greater part of the diphtheria poisons is found in the spleen, which in a healthy state contains no albumoses.* If the poisonous substance is simply absorbed from the membrane, why should it accumulate in the spleen and not in the blood? (See p. 149, Report, 1891–1892.) Again, if the albumoses found in the spleen derived their physiological action from mere admixture with the poison absorbed from the membrane, the effect would not be in regular proportion to the dose. That their effect is proportional to the dose given is demonstrated at p. 152 of my last report; and not only so, but this holds good for every individual case of diphtheria. In each case of diphtheria the albumoses obtained were of the same toxic power.

2. *The evidence of the action of the specific poison in cases of diphtheria.*

a. The character of the fever produced.—In typhoid fever and in septic fevers the chief symptoms of the disease are exhibited during the fever, a fall of the temperature to normal, or slightly below normal, indicating as a rule the commencement of convalescence. This in the main is correct, although other symptoms, perforation of the intestines and thrombosis, may occur in the afebrile period. These results cannot however be considered as features of the disease but as pathological accidents. In diphtheria, on the other hand, the febrile disturbance is not a safe guide to prognosis: in many instances while the disease is acute—*i.e.*, while there is still membrane present and no fever—the most serious symptoms supervene. In other words, in many cases of diphtheria the initial fever is of short duration, and afterwards, during an afebrile or only slightly febrile period, the patient gradually succumbs to increasing asthenia—to syncope, with sometimes slight signs of paralysis.

* See Halliburton, Gulstonian Lectures, "Lancet," 1893. Mr. Gourlay examined the spleens of healthy animals, and found albumoses absent. Von Jaksch is not correct on this point, and it is possible that he worked with spleens which were taken from animals with infective disorders or in which there was incipient decomposition.

An examination of the results of the injection of multiple doses of albumoses in rabbits, recorded in my last year's report, will show that while one animal showed during the whole period considerable fever, most of the animals showed at first a febrile disturbance which soon passed off, leaving the animal apparently in a normal condition; subsequently, however, *i.e.*, in the afebrile period, attacks of dyspnœa supervened, with a gradually progressive weakness and palsy. Two stages of the action of the poison were thus defined: one the acute febrile stage, with few symptoms but fever; the second the afebrile stage, in which appeared severe symptoms, ending in death. The experimental animals, therefore, showed exactly what occurs in diphtheria in man: viz., cases with high fever ending in death, and cases with an initial febrile period and a subsequent afebrile period ending also in death,—and during the whole time the nerve degeneration was proceeding. In rabbits two other symptoms besides fever are observed in the acute stage of the poisoning by the diphtheritic albumoses, viz., wasting and diarrhœa. In human diphtheria loss of flesh is not a marked symptom, and the well-nourished condition of most of the children dying of diphtheria is well known. On the other hand, diarrhœa is a symptom not constantly observed in acute diphtheria; and it was not always present in the experimental animals, only those showing it that received the largest doses of the poisons. There is some evidence indeed to show that the diphtheria bacillus has not precisely the same action in all animals. Thus when injected under the skin, or into the circulation of rabbits, fatty degeneration of the liver is, according to Roux and Yersin, almost constantly seen; and in some cases acute nephritis. In guinea-pigs the bacillus produces double pleural effusion, and in cats and cows (Klein) a well-marked fatty degeneration of the cortex of the kidney is a result of the action of the micro-organism. In cases of human diphtheria, as a rule the organs show post-mortem no definite naked eye changes, except the specific broncho-pneumonia occurring in connexion with laryngeal diphtheria. The heart may be slightly pale to the naked eye, but its muscle is firm; the liver, spleen, kidneys, and other organs are practically normal. Membrane may be present in the throat, or only a pultaceous muco-pus; or the mucous membrane may exhibit only a boggy, congested condition; membrane may even be absent (to the naked eye), although rarely from the larynx in fatal cases. Yet a chemical examination of the blood and spleen in such cases reveals the presence of relatively large quantities of specific poisons, albumoses and an organic acid; and microscopical examination of the nerves reveals early degeneration.* The results of the post-mortem examination in rabbits killed with these diphtheria poisons are the same as those usually found in fatal cases in man; the organs are normal to the naked eye, the heart muscle being somewhat pale, and the blood being slow to coagulate in some cases. The microscopical examination showed that the organs were normal except the heart, which showed extensive fatty degeneration; the nerves had undergone extensive degeneration. The affection of the heart in rabbits is the point in which the action of the albumoses differs from that observed in some though not in all cases of diphtheria in man. As will be presently seen, this action of the albumoses in producing fatty degeneration of the heart in rabbits is the key to the explanation of fatal syncope in human diphtheria.

β. The action of the diphtheria poisons on the respiration.—Attacks of dyspnœa, sometimes ending fatally, are met with during the course of acute diphtheria in man, irrespective of any mechanical

* See Report, 1891–92, pp. 161–68.

CHART showing the effect of the INTRAVENOUS INJECTION of DIPHTHERIA ALBUMOSES in a MONKEY.

Plain line.—Temperature curve. *Dotted line.*—Curve of respiration.

Weight of Animal.—1,575 grammes.

Dose I_1.—Injection of first dose of 0·3 gramme albumoses into R. brachial vein.

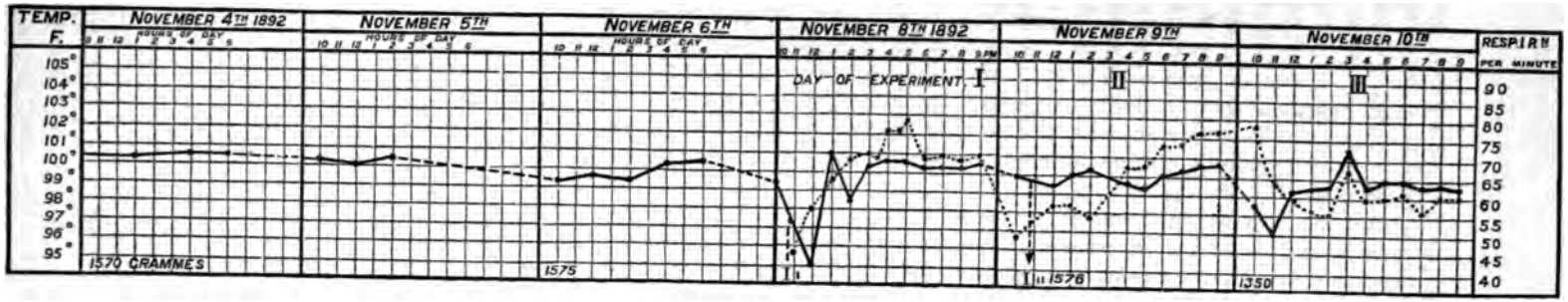
Dose I_{11}.—Injection of second dose of 0·3 gramme albumoses into L. brachial vein.

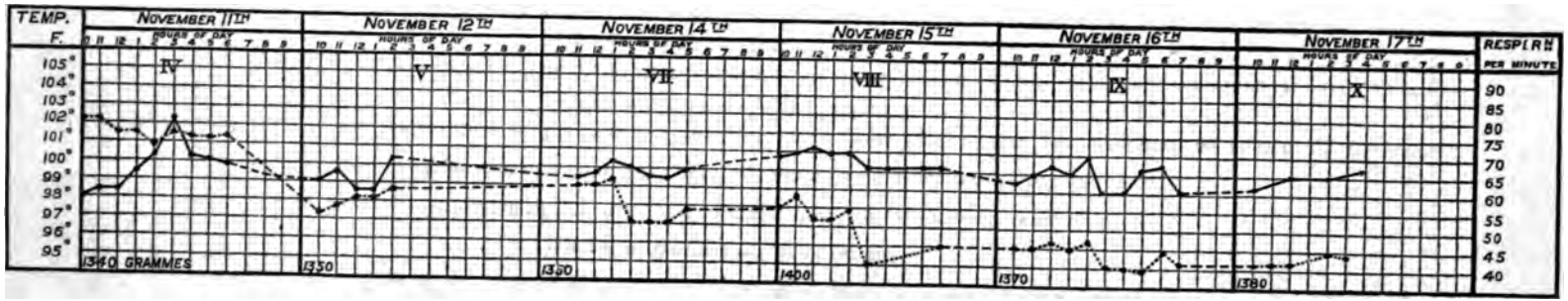
Result of experiment:—1. *On the temperature.*—This was not raised to any great extent, but was irregular as shown by the curve. Temperature taken in the rectum.

2. *On the respiration.*—The respirations were greatly quickened after each dose, and remained frequent until the 7th day of experiment.

3. *On the weight.*—After the second dose the animal lost in weight about 226 grammes, regaining somewhat afterwards.

4. *General symptoms produced.*—After the first dose there were no general symptoms. But in three hours after the second dose the animal became progressively weaker, so that in seven hours after the injection it could not sit upright or move the arms and legs. There was therefore complete motor palsy of the limb and trunk muscles; but no respiratory paralysis and no palsy of the facial muscles, as the animal lying on one side with food within reach of its mouth ate vigorously and swallowed perfectly. No knee jerks were obtainable, and no reflex on pinching the limbs. Without loss of consciousness therefore the albumoses produced complete motor and sensory palsy of the limbs and trunk, excluding the respiratory muscles. This condition lasted for over 24 hours after the second injection; in 26 hours the animal could sit up. There were still no knee-jerks. The animal gradually and completely recovered, and remained quite normal for several months, when it was killed. The knee-jerks reappeared on the second day following the injection, and recovery from the motor and sensory palsy was complete on about the same day.





App. B. No. 6.

On the Chemical Pathology of Diphtheria in relation to the Symptoms of the Disease; by Dr. Sidney Martin.

obstruction to the entrance of air into the lungs, or of any lung complication (bronchitis or broncho-pneumonia). The form of dyspnœa referred to, is to be ascribed to the action of the diphtheria poisons circulating in the body. Some of the experimental rabbits exhibited well-marked dyspnœa,* from which recovery in some cases occurred, although in other cases death followed the attack. This effect on the respiration I have since attempted to study in a monkey (pages 432–33). The animal was injected intravenously with two doses (0·3 gramme each), making a total dose of 0·38 gramme of diphtheria albumoses per kilo. of body weight. The result, as shown in the preceding chart, was that although there was but little effect on the body temperature of the animal, yet the respirations per minute after the first dose were greatly increased,—rising from about 40 to a maximum of about 80 per minute, and then falling again. The second dose produced a similar effect; but the respirations remained rapid up to the sixth day following the inoculation, falling on the seventh day and subsequently to between 30 and 40 per minute.

A similar, though less marked effect, was observed in another monkey after a single dose of 0·3 gramme, equal to about 0·23 gramme of albumoses per kilo. of body weight.

These experiments show that, apart from dyspnœa resulting from degeneration of the nerves of respiration (intercostal and phrenic), the diphtheria poisons directly affect the breathing, increasing the number of respirations per minute.

γ. *The action of the diphtheria poisons on the heart and circulation.*

In acute human diphtheria there is evidence of the heart being affected in two ways: first, as regards acceleration and irregularity of the cardiac beats; secondly, in the way of fatal syncope.

In acute diphtheria, uncomplicated by lung disease, the pulse is one of the most valuable means of prognosis. Acceleration or irregularity of pulse occurring during the febrile or afebrile periods, is a sign of "cardiac failure;" it is not apparently due to an affection of the cardiac nerves themselves, but to a direct effect of the poisons on the cardiac muscle.

All the experimental rabbits which were injected with the diphtheria albumoses or organic acid, showed well-marked fatty degeneration of the cardiac muscle; and this was found in rabbits 94 and 115 days after a single injection of the albumoses. Not only, therefore, is there evidence here of a direct effect on the cardiac muscle, but the degeneration lasted a considerable time, up to 16 weeks after the injection. Since the albumoses of anthrax and of infective endocarditis also produce fatty degeneration of the cardiac muscle (although not so markedly as the diphtheria albumoses), and since they do not produce degeneration of

* See Report, 1891–92, p. 155.

the nerves, it is clear that these albumoses act directly on the cardiac muscle, and indeed are cardiac poisons. It is true that in most cases of acute diphtheria in man, the heart muscle is not found fattily degenerated, and that the heart of the rabbit appears easily affected by these poisons; but fatty degeneration of a living tissue is only the final stage of some interference with its nutrition, and the diphtheria poisons in a fatal case may have already seriously affected the heart without producing any discernible degeneration of its muscle. The heart muscle is, however, obviously degenerated in certain cases of diphtheria; first, in some cases dying in syncope; secondly, in fatal cases of diphtheria palsy.

Fatty degeneration of the heart muscle is a feature of fatal diphtheria paralysis. I have examined the heart muscle in three cases of syncope and cardiac failure. One was a case of laryngeal diphtheria dying from cardiac failure. The heart muscle, after staining in osmic acid, showed small and numerous granules in every fibre; the striation of the fibres was indistinct but had not disappeared. The second case was pharyngeal diphtheria, in which at death the membrane had disappeared; death occurred from syncope. The heart muscle, stained in osmic acid, showed the fibres swollen; some of them containing fatty granules, and some appearing longitudinally striated. In the third diphtheria patient who died of syncope, every fibre in the heart muscle showed fatty degeneration, the transverse striation being completely lost.

There is thus evidence that even in acute diphtheria in man the heart muscle may show degeneration. The conclusions to be borne in mind, therefore, are that the signs of cardiac failure in diphtheria are due to a direct effect of the diphtheria poisons on the cardiac muscle; and that the fatal syncope which not infrequently occurs is essentially cardiac in origin.

In the later stages of acute diphtheria where death is not obviously due to cardiac failure, there is nevertheless evidence of the action of the diphtheria poisons. Thus in the late afebrile or slightly febrile stage, patients are prostrate, their strength gradually failing, paralysis of the palate often supervening or the knee-jerks disappearing. These are all evidences of the action of the poisons, as is shown by their effect on rabbits. Even in those cases that die with signs of inflammation of the kidneys, this condition goes *pari passu* with increasing prostration and slight paralysis of the palate.

8. *The mode of onset of the paralysis.*

The cases of palsy which supervene during the acute disease or immediately after it, are readily explained by the results of the experiments recorded in my last report. The diphtheria poisons act specifically on the nerves, producing degeneration; and they are present in the body of patients suffering from diphtheria. This nerve degeneration may indeed occur in the acute disease, as in the two cases recorded in my last report (p. 162, 1891–92).

it has not this power. Removal of the membrane in diphtheria is in reality only the removal of a foreign body; in this case, too, one which is not inert, but which is a most virulent poison.

2. There is at present no remedy known which will counteract the effects of the diphtheria poisons present in the tissues. All that can be done is by stimulating remedies to guard against cardiac failure, and to aid the excretion of these poisons by the urine.

In my next Report I shall deal with the chemical pathology of tetanus. During the past year I have been investigating chemically eight cases of this disease, but my experiments are not yet sufficiently advanced for publication.

APPENDIX C.

WATER FILTRATION and CHOLERA,* by PROFESSOR R. KOCH, of Berlin. (Translated from the German by ALBERT J. A. BALL, Esq., B.A., of the LOCAL GOVERNMENT BOARD.)†

BY all investigators of cholera, whose judgment has not been warped by fantastic fancies as to telluric or cosmic influences, or by a wilful adherence to theories refuted long ago, a more or less great importance has always been attributed to water as a conductor of cholera infection. The opinions differ only in this, as to how great was the influence of water. Several have gone distinctly too far in this respect, in that, led by occasional suprising observations, they declared water to be the exclusive conductor of the cholera germ. As to these, the designation much in vogue in recent times of "water fanatics" or "water theorists" may be not improperly used. That I do not belong to this class of cholera investigators will be readily admitted by everyone who knows what I have up to now said and written about cholera. I have always contended that according to past experience the direct communication of cholera from person to person was possible, though, by all appearances, it did not occur very frequently, but that, on the other hand, in the real epidemics and great outbreaks of cholera, the chief importance is to be attributed to indirect transmission by various agencies of the cholera germs, and that water is one of the most important among these. From some examples I have also tried to show further, that under certain conditions water has played the role which has been attributed to it; but, as far as my knowlodge goes, I have never expressed any opinion as to the extent to which this factor is to be considered as sufficient. A definite judgment on this point could not be formed at present, since the earlier investigations as to the relations of cholera to water were always made from a one-sided point of view, and were therefore seldom free from objection. Why, under these circumstances, they wish to make me out to be a "drinking-water fanatic" I cannot properly understand. It almost looks as if it were wished to force on me those opinions which could most easily be refuted.

In the last epidemic, as no one who is in earnest would dispute, water played a very important part. Nevertheless, we cannot even now know whether this will be the case in the future, and it is certainly better to defer a definite judgment as to the extent of the influence of water until we have collected further and more sufficient experience. But last year has again shown that we have every reason in the future to give our greatest attention to water-supply.

The cholera epidemic in the three towns of Hamburg, Altona, and Wandsbeck has been in this respect instructive in the highest degree. These three towns, which are contiguous to each other and really form a single community, do not differ except in so far as each has a separate and a different kind of water-supply. Wandsbeck obtains filtered water from a lake which is hardly at all exposed to contamination with fæcal

* Separat-Abdruck aus der Zeitschrift für Hygiene und Infections-Krankheiten, Vierzehnter Band, 1893.

† The translator has often preferred to translate Professor Koch literally rather than risk sacrifice of the author's meaning by a choice of more appropriate English.

matter; Hamburg obtains its water in an unfiltered condition from the Elbe above the town, and Altona obtains filtered water from the Elbe below the town. Whereas Hamburg was notoriously badly visited by cholera, Wandsbeck and Altona, if one excepts the cases brought thither from Hamburg, were nearly quite free from the disease. Most surprising were the conditions of the cholera epidemic along the boundary between Hamburg and Altona. On both sides of the boundary the conditions of soil, buildings, sewerage, population, everything, shortly, of importance in this respect, were the same, and yet the cholera in Hamburg went right up to the boundary of Altona, and there stopped. In one street, which for a long way forms the boundary, there was cholera on the Hamburg side whereas the Altona side was free from it. Indeed, in the case of a group of houses on the so-called Hamburger Platz, the cholera marked out the boundary better than anyone having the map of the frontier between Hamburg and Altona before him could have done. The cholera not only marked the political boundary, but even the boundary of the water-supply between the two towns. The group of houses referred to, which is thickly populated by families of the working class, belongs to Hamburg, but is supplied with water* from Altona; and it remained completely free from cholera, whereas all around on the Hamburg territory there were numerous cases of disease and deaths. Here we have to do with a kind of experiment which was performed on a population of over 100,000, but which, in spite of its immense proportions, complied with all the conditions which one requires from an exact and perfect experiment in a laboratory. In two great populations nearly all the factors are the same, one only is different, and that the water-supply. The population supplied with unfiltered water from the Elbe is seriously visited by cholera; the population supplied with filtered water is only visited by the disease to a very small extent. This difference is all the more important as the water of Hamburg is taken from a place where the Elbe is relatively but little contaminated; whereas Altona resorts to the water of the Elbe after it has received all the liquid and fæcal refuse of 800,000 people. Under these conditions there is no other explanation for the scientific thinker but that the difference in the incidence of the cholera on these two populations was governed by the differences in the water-supply, and that Altona was protected against the cholera by the filtration of the water of the Elbe.

It will not do to ignore this fact, and the only course open to us is to endeavour to show its bearing on the nature of cholera. As in this case we are dealing with an epidemiological fact of the first importance which is before us perfectly clear and obvious, and which, because it lends itself so easily to be tested later on and supplemented in every direction as to the correctness of the observation, and which therefore is in this respect quite unique, we have a right to demand of every investigator of cholera who claims consideration for his opinion that he should face this fact and should take up a definite attitude with regard to it.

For a bacteriologist there is nothing easier than to give an explanation of the restriction of the cholera to the territory of the Hamburg water-

* Besides this group of houses there is on the Hamburg territory only the brewery in St. Pauli, which obtains its water from Altona. The assertions that there were other houses at Hamburg which received their water-supply from Altona, and yet had cholera, and that there were houses in the town of Altona which received their water from Hamburg without suffering from cholera, are completely untrue, as I can most certainly assert on information personally obtained by me in Altona and Hamburg.

supply. He need only point out that cholera bacteria were brought into the Hamburg water either from the Hamburg sewers, or what is much more probable, from the excrements of persons suffering from cholera who were living on the boats anchored near the place from which the water-supply was obtained, and then assume that afterwards more or less numerous cases of cholera must occur among those who use this water according to the degree of its impurity. The town of Wandsbeck was spared because its water was not exposed to a contamination of this character, and was, moreover, filtered. Altona obtained water which at its source was much worse than that of Hamburg, but which by careful filtration was completely, or nearly completely, freed from cholera bacteria. This view is in complete accordance with all past bacteriological experiences, and, with our present knowledge respecting infectious matter, it contains no contradictions and is not forced or artificial

Why one should wish to attribute the Hamburg-Altona cholera to cosmic, telluric, or purely meteorological factors is a puzzle to me; for sky, sun, wind, rain, &c., were absolutely equally distributed on the two sides of the boundary of the territory. I hardly think that any attempt will be made to find an explanation from this point of view.

I was particularly interested in what the "soil theorists," or "localists," as they now prefer to call themselves, would say about the Hamburg-Altona cholera. Thus far they appear to admit, though somewhat unwillingly, the real epidemic remained restricted to the territory which obtained unfiltered water from the Elbe, and that therefore the unfiltered water must have exercised some influence; but the explanation as to how this influence made itself felt through the medium of the soil is given in so unsatisfactory a manner that I should hesitate to discuss it if it did not come from so respected an authority.

The "localistic" view is to the effect that the water did not have an "infective" but a "predisposing" influence; that in this way the unfiltered water brought filth into the dwelling, into the streets, and to the soil, and that it thus created a suitable soil favourable to the development of the cholera germ. But the respected "localist" has in his difficulty not considered how immeasurably small the amount of filth is which, through the use of water even in unfavourable circumstances, can be brought into dwellings and to the soil, compared to the much greater quantities of filth which daily life brings to the dwelling, and which is continually being accumulated in streets and courts by men and animals. He has also not considered that the Elbe water which is taken in at the waterworks does not receive regularly, but only quite exceptionally, and this at high tide, an admixture with the sewage of the town of Hamburg. He appears, however, and that is the greatest objection that can be made to his contention, to have completely forgotten that Hamburg is one of the very best drained towns, and that it is supplied with contrivances which convey the filth in the quickest way possible from the houses, courts, and streets, beyond the limits of the town. What, indeed, is the use of drainage if it is not able to remove and render harmless so small an addition of organic matter which is brought in by unfiltered water? The soil theory could not have given a more perfect proof of its complete failure than by making this unfortunate attempt at an explanation.

In any case the "localists" will in future have to look upon the filtration of water, not as a secondary matter, but as a very useful and, under certain circumstances, indispensable measure. And here, again,

we note what is seen in so many other cases, that one can have different views as to the explanation of a fact, but that one nevertheless arrives at the same result as regards practical treatment.

The Hamburg-Altona cholera has given us an indisputable proof that the filtration of water by sand, in the way in which this is done at Altona, gives a practically sufficient protection against cholera infection. I specially say that if the filtration is to be a protection it must be performed as it is in Altona. I know a fairly large number of waterworks with methods of filtration, and I know that only a few of them keep so strictly to the rules which are now considered best for the filtration of water as Altona does, and I have every reason to suppose that the protection from cholera would not everywhere have succeeded so well as in Altona.

In order to make myself intelligible to those readers who have no special knowledge of the technique of water filtration, I must now consider more closely some of the procedure which takes place in filtration by sand.

The problem of filtration is to purify water from the matter held in suspension. Matter which has been dissolved [in the water] goes through the filter with hardly any or no perceptible change. As the chemical investigation of water has chiefly to deal with inquiry into the constituents which have been dissolved it cannot aid in studying the processes of filtration. But in earlier days one was so much accustomed to judge the character of water according to its chemical characteristics that, in complete ignorance of what took place in the process of filtration, one attempted to test and regulate the process chemically. Naturally no useful result ever came of this. The specialists in filtration had found this out, even in early times, and had attempted to obtain aid in some other way. They tested the water in glass or metal cylinders, the so-called "water-tests," as to its transparency before and after filtration, and according to the result they have judged of the value of the sand filters. By this simple means they succeeded in discovering the most important conditions for a sufficient purification of water from its suspended constituents. From this it appeared that the real filtration does not take place in the sand, but that, by a deposit from the still unpurified water, a layer of mud is formed on the top of the sand, and that this layer of mud which is over the sand is the real filter which retains the suspended constituents from the water. In the process of filtration the important point is, first, that a proper thin layer of slime should be formed and that it should not be disturbed during the process of filtration, and that when by further continuous deposit of filth it becomes too thick, and therefore too impermeable to water, it should be removed. According to all appearance, different natural waters are capable of producing the filtering mud layer in very different degrees; according to the amount of mineral and vegetable suspended matter held in suspension. Some river waters which are especially rich in clay constituents can deposit a good filtering mud layer in eight or ten hours. Other kinds of water, having vegetable matter in suspension, require a longer time, at least 24 hours, to form this deposit. At certain periods of the year, especially at the time of the so-called "water-bloom," owing to the appearance of innumerable microscopic algæ, the vegetable constituents suspended in the water are increased to an extraordinary extent, and are of a particularly slimy character, and form, therefore, a layer which in a few days becomes nearly impermeable to water and must be removed. From these brief remarks it appears that in sand filtration we are not dealing with so simple a matter as is often supposed. It has also been discovered that in the gradual wearing out of the sand layer, it should never be allowed to get below a certain thickness, about

30 c.m., and that a certain pace, about 100 m.m. (3·95 inches) in the hour, must be allowed for the downward movement of the water through the sand layer to obtain the most perfect purification. Some further rules of filtration of less importance need not be noticed here; those which I have given are the most important and are sufficient to an understanding of that which follows.

If in the process of filtration any disturbance takes place, and the above-mentioned rules cannot therefore be observed, this will at once show itself in the character of the filtered water. It no longer obtains the complete transparency when investigated by the "water-tests." To the consumer this, it is true, is hardly ever noticeable, for even water insufficiently purified will still appear clear in water bottles and in drinking glasses. Partly on this account, partly because the disturbances in the process of filtration as a rule continue for only a short time, in earlier days no great importance was attached to these disturbances, and often it was not considered to be even necessary so to construct waterworks as to exclude from consumption water which had been insufficiently purified.

That is, however, all changed since we have obtained better knowledge as to infectious matter, and have become persuaded that water by the process of filtration must not only be rendered more clear, but above all must be freed from the infectious matter which has got into it. In order to test water, as regards the amount of infectious matter contained in it, the "water-tests" are, of course, insufficient, and for this purpose bacteriological investigations are requisite, and have been recognised as the only trustworthy means in order to test the sufficient purification of water by a process of filtration. The application of bacteriological investigations to the study of the processes of filtration has confirmed generally what was previously known on the subject; but it very soon led to the discovery that even slight and quickly passing disturbances in the process are not to be regarded as unimportant, as used formerly to be the case. If a filter works satisfactorily in every respect, there will be found, as experience shows, less than 100 germs capable of development in 1 cubic c.m. of filtered water; and this is independent of the amount of bacteria contained in the natural water, whether such amount should be 100,000 or only a few hundreds in a cubic centimetre.* But the slightest disturbances in the process of filtration, for instance, the quickening of the pace of filtration to over 100 mm. [per hour], disturbances of the surface mud-covering, &c., tend as a consequence, to an immediate increase of germs in the filtered water. The small number of germs which remain, even when the process is perfect, is due doubtless chiefly to the filtering material being covered with a vegetation of bacteria, and is in short due to the fact that the lower sand layers, and the gravel and stone layers, like all objects washed by water, in the process of time become covered with vegetable micro-organisms. These are naturally harmless dwellers of water, which can be found in all water, and which do no injury. A small proportion of the bacteria found in filtered water have their origin, according to the investigations of Fraenkel and Piefke, in the natural water. The very best filtration processes are not sufficient, therefore, to keep back all micro-organisms. Even this must be possible of attainment, but one would have then to filter at an

* If the pace of filtration is 100mm. in the hour, difference in the natural unfiltered water as regards the amount of bacteria it holds may be of value in determining the amount of bacteria in filtered water, but this last amount should, even in the case of very contaminated natural water, never come to more than 100 germs in a cubic centimetre.

even slower pace, perhaps also through thicker strata, and using other filtering materials, and this would lead to so great an increase in the size and expenditure of the waterworks that it would hardly be practicable. According to all appearances, we have with the present processes reached the limits of that which is practicable.

But the best proof that we can be satisfied in practice with what we have already attained is shown by Altona in last year's epidemic. The waterworks of this town, which are under the superintendence, fortunately, of one of our ablest and most experienced specialists in filtration, never during the epidemic allowed the pace of the filtration to go beyond 100 mm., and it is thanks to this precautionary measure that Altona was visited by the cholera in so small a degree. According to my information as to the statistics of cholera in Altona, there occurred about 500 cases of disease there, of which at least 400 were brought from Hamburg, or which were proved to have been due to the traffic of the harbour, or to have been communicated immediately from cases there. Of the 100 other cases, of which one cannot discover the direct or indirect connexion with Hamburg a certain number probably had their origin there, although no direct connexion can be traced. Whether of the remainder which occurred independently of Hamburg, and which really formed the epidemic in the town of Altona, a certain number of cases can be ascribed to the imperfect purification of the infected Elbe water through the sand filters it is now impossible to determine. But I consider it to be very probable that, according to the investigations of Fraenkel and Piefke, if the pace of filtration is 100mm., the bacteria of cholera cannot be completely kept back by the sand filters. In any case, the number of cases which occurred at Altona in this way was not of importance, and one cannot demand that, in order in future to avoid with certainty the possibility of such occasional cases, one should give double or treble dimension to the existing sand filters. We must therefore admit that, according to all that we have learnt about sand filtration, even under favourable circumstances, it cannot give absolute protection against the danger of infection, but, as we have already said, it can give such a protection that in practice we may, under existing circumstances, be satisfied with it.

In itself this result will in times of cholera tend to calm our minds as regards those towns which make use of sand filtration; but the present cholera epidemic has unfortunately taken care that this calm must not be considered as quite justified. It has shown us, by some remarkable examples, that the mere provision of filters is not in itself sufficient, but that they must be constructed perfectly in every respect, and must then be superintended with the greatest care, and continually tested by bacteriological investigations, if the protection which they are expected to give is not to be more or less illusory. The cases which have put us in some uncertainty as to the result of filtration by sand are those of the cholera epidemic at Nietleben, near Halle, and of the epidemic at Altona. These are so instructive that they deserve further consideration.

The provincial lunatic asylum of Nietleben, some kilometres to the west of Halle, obtains its water-supply from an arm of the Saale which is called the "Wild Saale." The water of the Wild Saale flows with a natural fall into the filtering area, and after it has passed this it is brought by means of an iron "lifting main" to the pumping station. The pumps lift it then into several elevated reservoirs, from which it is distributed. The filtering area to which our interest is for the moment restricted has been in use since 1883. It is in its processes completely in accordance with the filtering works erected in recent times. It consists of three covered filters constructed of masonry, adjacent to each other,

each having a superficies of 41·25 square metres. The filtering material consists as usual of a foundation of stone, on which there are layers of gravel and sand, the last of a depth of 66 c.m. The river water reaches the filter not immediately, but first goes through two basins adjacent to each other, each of a superficial area of 11·25 square metres, from which it is brought by iron pipes to the superficial surface of the sand layer. After the water has gone through the layers of the filter, it is collected in a canal at the foot of the filter, which is connected with three smaller tanks, the so-called "collecting tanks" on the other side of the filter These last being connected with each other in a way, form the pure water reservoir from which the filtered water is absorbed by the lifting main of the pumping station. The filters were, according to the statement of the filter superintendent, who was officially examined, treated in the following way.

As soon as one of the filters was so covered with mud that it had to be cleansed, the flow in and out was stopped, and the water, which was standing over the sand layer, was pumped away with a hand pump till it measured only a depth of 10 c.m. Thereupon, the filter was again put into communication with the collecting tank, which belonged to it, and the water in the collecting tank, after the communication with the lifting main was broken, was taken away by pumps. Now the water which remained on the surface of the filter sank into the filtering material, whereby the surface of sand was rendered dry. Wooden planks were then laid on the sand, and mounting upon these, the cleaners removed the uppermost layer of sand to the extent to which it appeared dark and muddy. When this mud was removed the surface of sand was again made level, and the planks which had served as a stand for the feet were removed. In order again to fill the filter the dams separating the outer basins from the filtering area were pushed open slowly in order that the upper layer of sand might not be too much disturbed by the inflow. This, however, could not even by a slow inflow, be avoided in that part of the filtering area which was next to the dam. The opening of the dam took about 20 minutes. About three-quarters of an hour after the dam was pushed open, the water in the collecting tank of the cleansed filter stood higher, as a rule, than that in the adjacent collecting tanks, and then the connexion with the two other collecting tanks and the lift pump was restored, and thereby the process of filtration again put into regular order.

Originally this filter was calculated for the 700 inmates of the institution, and it was understood that 300 litres per head should be supplied daily and that the pumps should work for 15 hours each day. It was necessary therefore to filter, every hour, 14 cubic metres of water. To perform this there were three filters, two of them with a superficial area of 82·5 square metres, the third could not be brought into calculation as, owing to the necessity of cleansing, it had to be considered as out of use. On the basis of these figures we arrive at the pace of filtration of 170 mm. in the hour.

In the first period of these works the several filters appeared capable of performing their duties for about three weeks. Very soon, as early as 1884, the filtration was less good and one was obliged every 14 to 10 days to cleanse the filters. At the same time it was discovered that the lifting main, which, as we mentioned above, brings the water to the pumping station, was not impermeable (it originally consisted of clay pipes). It took up considerable quantities of water from the sub-soil in which it was fixed. In reality, therefore, the filters working for 10 to 14 days had even then only partly supplied the wants of the institution. The clay lifting main was replaced by an iron one so that only filtered water

from the Saale could come into the institution. At the same time the institution was considerably increased, the number of inmates being raised from 700 to nearly 1,000. Thus the discrepancy, which even at the commencement existed between the capacity of the filters and the demands made upon them, became so great that in order to obtain the amount of water which was wanted, there was nothing else to do but to make the sand layer of the filters as thin and permeable as possible. The periods of cleansing became even shorter, and in the two last years (1891–92) the filter superintendent had in summer to cleanse two filters every week, and in winter all three filters each week. Filter No. 1 was cleansed every week on Monday and Tuesday, filter No. 2 on Wednesday and Thursday, filter No. 3 on Friday and Saturday; on Sunday all the three filters were working.

These filter works had some faults even in their construction. An instrument was wanted to measure the pace of filtration and to regulate it; badly filtered water could not be removed; in working the filter the sand layer could not be filled from below with filtered water, and the disturbance of the sand by the flow of the natural water brought to the filter could not be avoided. Yet these are faults which are found even in great filter works. They make it extraordinarily difficult to obtain good filtered water, but they do not make it impossible. Had one made use of the Nietleben filter works with the proper knowledge of a specialist, and had one examined the filtered water bacteriologically, one would have obtained, it is true, less* water, but a water to which hygienically there would hardly be any objection. But from what we have already described, there can be no question as to the treatment of the filter being conducted with proper knowledge. Among those who superintended it, there was obviously no one who had the faintest knowledge of how a filter should be treated. The filtered water was at times chemically investigated, and it was believed that if the chemical analysis showed the water to be free from ammonia and nitric acid (Salpetrige Säure), the filter work did its duty; more especially as the analyst reported that by aid of a microscope some brown and green algæ were to be found in the water, but no "cocci and bacteria" and "nothing really dangerous." A proper bacteriological investigation never once took place before the outbreak of the cholera, and yet such an investigation would have at once shown that the filters only eliminated from the water the larger† objects held in suspension. Micro-organisms, and especially infectious matter, could by such a process be only very partially kept back. Ultimately the object in view was to force as much water as possible through the filtering beds, and then it was impossible to work the filters according to rule and to leave on the top of the sand the mud layer which is indispensable for filtration.

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* On the supposition that there are only two filters in full use, and that they are working on a total superficies of 82·5 sq. metres, there would be, if the pumping works were continuously in use (that is 24 hours and not 15 hours per day) with the pace of filtration at 100 mm. in the hour, still a daily supply of 198 cb. m. of filtered water, or nearly 200 litres per head per day. But in case of necessity one might have gone far further in diminishing the supply, for 200 litres mean a very generous water-supply. I had occasion quite recently to visit another lunatic asylum which had not yet been opened, but as to which I receive the official assurance that they would have to be content with a supply of 25 litres per head per day, as even with the best intentions more could not be obtained (it may be noticed that this institution has not to supply any steam boilers, as is the case in Nietleben).

† And not always these, as the water in the institution was often so little clear that it was not willingly drunk by those to whom it was offered.

In Nietleben the fact does not appear to have been known that water must be allowed to rest at least four and twenty hours over the sand in order to enable the filtering mud layer to be formed, as from the very beginning the process of filtration commenced three-quarters of an hour after the water was allowed into the filter. But nevertheless, during the filtration, after one or a few days there was so much mud on the surface of the sand that then at least the water was properly filtered. In recent years, however, this was not the case, for the filters were only kept going about five days, and as soon as a filtering mud covering was formed it was at once scraped off; ultimately the filtration became one only in name, and the water in reality passed through the filter unpurified. In order to prove this, Professor Pfuhl examined the water before and after filtration. He found in the unpurified water of the Saale 302,400 germs in a cubic centimetre, and 52,410 germs in a cubic centimetre of the filtered water. If only one single bacteriological experiment of this character had been made before the breaking out of the epidemic, and proper importance had been attached to the result, the danger would not have been met so carelessly, and precautions would have been taken in time to remove the evils, and the institution would have then been preserved from a great misfortune. And there was every reason to devote the greatest attention to filtration, for, as I shall have to explain later on, the conditions in Nietleben are quite similar to those in Altona. The water which is to be filtered is seriously exposed to contamination. The Saale water flows laden with the fæcal matter of many towns and villages situated higher up the stream, and especially from Leipsic, the sewage of which is brought into the Saale by the Elster, which flows into it a mile above Nietleben. What is even more serious is that 500 paces above the intake a small dirty rivulet flows into the Saale which has the very appropriate name of Saugraben (Pig's ditch). This stream comes from the village of Nietleben, and there takes up all the filth of the place and also of several mines and factories, and immediately before flowing into the Saale it receives the drains from the sewage farm of the asylum. The thick water of the Saugraben does not mix quickly with the Saale water, and flows for a long time different in colour along the bank until, hardly diluted, it reaches the intake, which therefore brings to the filter works not the pure Saale water but the water of the Saugraben only slightly diluted. One would surely not have risked the establishment of waterworks immediately below a tributary so contaminated had there not been the fullest assurance that by careful filtration the water was purified from noxious matter, and it could certainly not have been suspected that in the way in which the waterworks were used they not only gave no protection to the institution against infection, but in reality acted as a trap for infectious matter, as was ultimately unfortunately found to be the case. The course which the cholera took at Nietleben proved that the badly filtered water was the conductor of the infectious matter, and, moreover, proofs have been found of the existence of cholera bacteria in the water of the Saale below the confluence of the Saugraben on two separate occasions. Cholera bacteria were also found in the filtered water taken from the collecting tank of filter No. 2, and even, in one case, in the water actually supplied to the institution.

In the waterworks of Nietleben we have been made acquainted with waterworks which, in spite of certain defects, would, if properly and carefully used, still have given satisfactory results; and these defects could with slight alterations have been nearly completely removed. Now we will learn, on the contrary, from the case of the Altona

Waterworks, that the present existing filters have faults the importance of which have so far either not been known or sufficiently appreciated, and against which even the best superintendence is of no avail.

The Altona Waterworks are among the oldest in Germany. They are situated at Blankenese, 1½ miles (7 English miles) below the place where all the sewers of both the towns of Hamburg and Altona discharge themselves into the Elbe, and are on the same bank as the outfall of the sewers. The intake is subject to the tide, and the difference between high and low tide is on an average over two metres. During the ebb, the waterworks receive the Elbe water of the right bank, which is much contaminated by the town sewage; during the flood they obtain water from the returning stream, which is mixed with great quantities of less contaminated Elbe water. The difference between ebb and flow can easily be seen in the bacteriological character of the Elbe water, which shows important variations as regards the amount of germs contained in it; in short intervals a few thousand and then again some hundred thousand germs can be found in a cubic centimetre. This is especially the case in winter, when, other circumstances being the same, the number of germs in river water would decrease considerably and equally. The pumping works are situated immediately on the bank, and they conduct the water 34·7 metres high to Baursberg, a height overlooking the steep bank of the Elbe, on which the waterworks are constructed. These waterworks consist of two "depositing tanks," in which the somewhat strongly mixed Elbe water loses a part of the matter held in suspension, and of eight open filters. Each filter has a superficial area of 800 square metres. From the filters the water goes to a pure water reservoir of a capacity of 3,050 cubic metres, and from thence, with a natural fall, to the town. The construction of the filters is not different from that in other works.

Since the summer of the year 1890 the water has been bacteriologically investigated, but only once each week, and only samples taken out of the pure water reservoir. Until the summer of 1892, in a period, therefore, of two years, the number of germs in a cubic centimetre of filtered water has, with the exception of a short period in January 1891, always remained under 100. Figures of 20 have been the rule, colonies of 50 and 70 the exception. This excellent result is undoubtedly due to the skilful and careful superintendence of the filter; and it should be noted that it was made especially a point in these waterworks that the pace of filtration should not exceed 100 mm. in the hour. Generally the pace was even slower. Of special importance is also the fact that the same low numbers of germs were continuously obtained, although the natural water of the Elbe was continually changing as regards the amount of germs contained in it, and at times was quite exceptionally contaminated. This is a proof that a filter properly worked can give even with the worst material—for water more contaminated than the Elbe water at Blankenese could hardly occur elsewhere—a filtered water containing less than 100 germs in a cubic centimetre.

We can also learn from the Altona filters that disturbances in the process of filtration are at once to be seen in the results of bacteriological examination. They can also, and not rarely, be seen in the results produced by the infectious matter which is not sufficiently kept back by the filter, that is, in the occurrence of infectious diseases in the district receiving the water-supply. Fortunately, there are not many infectious diseases which can be conveyed by water. With certainty we only

know two, cholera and abdominal typhus* [enteric fever]. Cholera we have only periodically, but abdominal typhus is an endemic disease and one much spread everywhere and constantly in our midst. We can suppose that our great towns are never quite free from typhus, and that in the sewers, beyond other fæcal matter, there is also that of the typhus patients, and that in it the infectious matter of abdominal typhus is contained. If now, as is usually the case, the sewage is quickly taken out of the district by sewers and not brought back by the water-supply' then the abdominal typhus, in so far at least as it affects the infection by water, decreases. It need not therefore completely disappear, as there are other means of spreading this disease besides water, as indeed has also been found to be the case with cholera. I might even suppose that abdominal typhus is in even a less degree dependent on water, and that it can find its way without water more easily than cholera with its exotic and really tropical infectious matter, which requires damp and warmth for its existence in a much greater degree than the typhus (enteric fever) bacillus, which is more capable of resistance. Still even typhus, as is proved by numerous observations in recent times, can be spread by water,† and when in the district receiving the water-supply there suddenly occurs a remarkable increase of cases of typhus, unconnected with each other and spread equally over the district, we have then good reason to investigate whether the epidemic is not one which is due to the water-supply. And if in such a case the suspicion is confirmed by later investigations, the typhus has in a way served as an index for the defects in the water-supply. Such a connexion has been proved in fact in all cases in which the investigation was carried out thoroughly and without prejudice, and the prevalence of typhus in a locality will in future be a most valuable sign-post for discovering defects in the water-supply.

Something of this character occurred also in Altona. The town has, during the last decennium, had epidemics of typhus which, on account of their peculiar characteristics, awakened the suspicion that they must stand in some connexion with the water-supply. For the first information on this subject, we have to thank Reincke. He showed that the typhus epidemics in Altona did not take their course contemporaneously with the epidemics at Hamburg, but followed the latter epidemics by some weeks, and that in Altona the typhus occupied the same area as the water-supply. He therefore already at that time gave it out to be his suspicion that the epidemic was to be ascribed to the water-supply. In this suspicion he was confirmed by the result of bacteriological investigations which were made by Spiegelberg in the years 1885 and 1886. From these investigations, which unfortunately were made only at monthly intervals, it appeared that the number of germs in the Altona filtered water had much increased shortly before the outbreak of the typhus epidemic of 1886 (there were up to 1,150 in a cubic centimetre on the 20th of February 1886). Reincke came to the conclusion that there must have been disturbances in the process of filtration, without, however, being able to discover them. Wallichs went somewhat further in the solution of this question. He especially

[* Here and elsewhere the term "typhus" corresponds with enteric or typhoid fever in English.]

† When I here say that typhus can be conducted by water I am prepared to be denounced on this account by certain people as a "water fanatic" with regard to abdominal typhus.

noticed that every year, from 1886 to 1888, a typhus epidemic developed itself in connexion with a long period of frost. In 1886 a frost period in February was followed by a typhus epidemic in March. In 1887 January was the colder month, and in that year the typhus reached in February its greatest virulence. In 1888 February was again colder, and March was the month in which the typhus was the most virulent. Also in 1891 an increase of typhus in February followed a period of cold weather in January. During this last typhus epidemic the bacteriological investigations of the Altona water which have been referred to above were available. From these one could see that just as in Spiegelberg's investigations, shortly before the outbreak of the typhus epidemic, the number of germs in the filtered water had increased considerably. According to Wallichs, on the 13th of January there were 2,615; on the 20th of January, 1,361. According to Director Kümmel, on one occasion, 1,900, and on another 1,100. Wallichs maintained, it is true, that he was not thereby justified in accusing the water-supply as the certain cause of typhus, but he expressed a strong suspicion that it might be so, and already put the question whether, perhaps with the open filter, the filtration might not be disturbed by ice-formations or whether possibly it might not occur that when cleansing the filters in a period of hard frost the superficial surface of the sand might freeze and thus filter insufficiently. By the adherents of Kümmel these suggestions were then still unfavourably received, but Kümmel later on brought up as a proof against the theory that the epidemic in Altona was due to the water-supply the fact that in the year 1892 there was a typhus epidemic in February, during and before which there was no increase in the number of bacteria in the filtered water. I do not consider this last objection as being to the point, for the filtered water was only investigated once each week, and not the water of each separate filter but the results of the total filtration as taken out of the pure water reservoir. In this kind of investigation, as we shall see later, fluctuations in the number of bacteria contained in the water can be easily overlooked, especially if the disturbances in the filtration are restricted to a single filter. Kümmel himself says that in 1891 the number of germs increased very rapidly, but that afterwards it decreased equally rapidly; as soon as a couple of filters had been cleansed, the number of germs at once fell to the normal number, and within three weeks everything was over. Such periods of increased numbers in the germs can be, however, still shorter, sometimes lasting only a few days, and if the investigation takes place every seven days they can easily escape observation.

After the attention had by the earlier typhus epidemics been drawn to the possibility of an insufficiency in the filtration during a cold winter, there was again suspicion attached to the waterworks when, in January and February 1893, cholera cases, spread over the whole town, occurred without connexion with each other. As to these cases being brought from Hamburg, which in the summer had been a frequent means of infection, there was no suggestion, since in some of these cases the persons had not left their dwellings, and in the others no connexion with Hamburg could be shown. More especially could this not be thought of as at that time the cholera in Hamburg had been quite extinguished. With regard to some of the last cases in Hamburg, it was supposed there that the infection came from Altona, or at least from the Hamburg suburb of St. Pauli, which had been supplied with Altona water for some months. This fear had, as a consequence, that the mains supplying the Altona water were cut off at St. Pauli.

The question was then raised whether the suspicion was a reasonable one, and for this purpose recourse was again had to bacteriological investigations. From the 1st of October 1892, Weisser had nearly every day investigated samples taken from the pure water reservoir of the Altona waterworks. From Weisser's figures it could at once be seen that already in the first week of December a quickly passing increase of bacteria had taken place in the filtered water. From the 30th of December, 1892, the number of germs again began to increase, and reached on the 12th of January, 1893, the number of 1,516. It then decreased again for a short time, but rose in the last week in January from 1,200 to 1,400. That some kind of disturbance must have occurred in the process of filtration was therefore beyond doubt. When such disturbances occur they naturally never affect all the filters at the same time, but always only some of them; and in order to discover the defect one ought to have at once bacteriologically investigated each filter. Unfortunately, this could not be done straight off, as the filters were not supplied with means so as to enable the filtered water to be taken separately from each of them. Only filter No. 8 could be investigated by itself, Nos. 1 to 4 flowed together in a common pipe into the pure water reservoir, so also Nos. 5 to 7, and Nos. 9 and 10, so that these filters could only be tested in groups. Already on the 31st of January, according to the investigations of Weisser, the number of the germs had decreased to 354 (on the day before they were 1,256*). From the 1st of February we have at our disposal the results of the investigations of a bacteriologist who was appointed at the Altona waterworks in order to make daily investigations as to the results of the separate filters. From the 3rd of February filter Nos. 9 and 10, and from the 8th of February all the filters, could be separately investigated. The figures for the month of February are to be found in the table [below].

The figures on this table are of the greatest interest. They show that on the 1st of February filter No. 8 did not exercise its function properly, as also [? on February 2nd] group 9 and 10, in which, as resulted from the investigation on the following day, filter No. 10 was the one which filtered badly. Also group 5, 6, and 7 did not give a sufficiently purified water. In the pure water reservoir there were found at that time 154 germs in a cubic centimetre, a figure which would have hardly given reason to suppose a disturbance on the process of filtration; and yet two of the filters at least were filtering badly. But the resulting defects were so far concealed by the better performances of the other filters that the total water of the pure water reservoir could only give a very faint intimation, which might easily have been overlooked. On the previous days, when much greater numbers of germs were found in the mains, the disturbances in the process of filtration must have been much more considerable. It may be supposed, by the fact that the filters had in the process of filtration obtained an increased layer of mud, that these disturbances had diminished to the extent shown by the figures of the 1st of February.

* The last figures are not from samples from the pure water reservoir, but from a tap in the Garrison Hospital at Altona. The water of the pure water reservoir would, owing to its being nearer to the filters, probably have given somewhat lower figures.

NUMBER of GERMS contained in the WATER of the ALTONA WATER-WORKS.

February.	Filter.										R.W.	E.W.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.		
1			—			—		832		—	154	28,520
2			88			212		550		908	142	35,340
3			106			374		R.	76	636	110	40,920
4			123			276		208	96	530	146	31,360
5			176			206		544	84	362	105	33,480
6			418			306		401	82	334	68	39,680
7			234			204		446	94	R.	94	41,660
8	50	22	40	24	28	136	146	368	84	152	130	25,560
9	48	28	R.	32	54	194	152	182	64	122	72	44,140
10	108	50	88	20	28	120	98	110	58	112	126	42,160
11	68	60	76	78	36	140	R.	126	76	204	152	34,100
12	72	58	240	60	38	110	288	80	70	282	82	26,040
13	34	30	560	48	28	82	214	186	86	374	104	24,800
14	40	46	354	24	18	52	164	142	46	364	142	34,080
15	26	28	76	14	18	44	74	48	26	72	49	40,260
16	38	26	84	24	22	52	76	60	R.	120	78	25,420
17	20	36	156	R.	22	48	82	86	324	130	95	26,400
18	26	18	102	54	32	54	112	72	82	126	91	26,440
19	24	20	88	78	28	44	98	82	64	102	70	24,800
20	26	22	70	104	24	36	96	88	34	78	46	19,840
21	20	14	80	68	R.	34	96	44	30	152	50	34,720
22	34	R.	46	62	158	34	68	36	64	*	42	18,250
23	46	246	52	66	138	46	56	54	72	174	68	14,560
24	22	42	32	36	72	22	72	76	34	44	54	11,080
25	18	36	30	28	48	16	48	42	36	38	48	12,360
26	14	20	24	21	34	12	40	36	28	34	32	9,370

R. Cleansing of the filters. R.W. Pure water reservoir. E.W. Elbe water before filtration. * Experiment failed.

Further attention should be also given to the bacteriological results of the filters immediately after they have been cleansed. The table shows us that a filter, after cleansing, exercises its functions insufficiently for some time. From the figures of the following month, which on the whole agree with those of February and therefore need not be given, it appeared that the renewal of the sand layer, which must be renewed in every filter from time to time, occasions an even greater disturbance than a simple cleansing. Filter No. 10, after it was filled with sand on the 13th of March, had on the 15th March 1880 germs; on the 24th of March still 148. Filter No. 8 had, previous to the renewal of the sand, for many days 20 to 30 germs. Immediately after the renewal, 1,364 germs (on the two following days, 468 and 244).

In other respects the investigations which were daily carried out confirmed the previous experiences that a filter filtering properly should give water with less than 100 germs.

These results are of the greatest importance for forming a judgment as to the performances of a filter, and I shall have later on to go back to them.

The filter which was working worst was, according to the investigations of the 1st of February, filter No. 8. An attempt was therefore made to discover the defect which had caused the disturbances in filtration; fortunately the defect was discovered. On the 3rd of February the water standing over the sand layer of the filter was let off and the mud layer was removed. As Mr. Kümmel wrote to me on the 4th of February, it was found that the sand layer was frozen at the top. According to the communication of Mr. Kümmel the freezing of the sand layer took place in the following manner. When, after a longish period of frost, a milder weather had followed, it was thought well to make use of it in order to cleanse the filters. This was first done at a moderate cold temperature with filter No. 8, which was freed from ice, and the water allowed to run off. Now, however, unexpectedly the temperature changed to 14 degrees Réamur of cold, and as a result the surface of the filter was frozen completely, so that the cleansing could only be finished with the greatest difficulty. The filter was then filled with water and allowed to stand the usual period of time, but the result was that it hardly filtered at all; that is, that hardly any water passed through it. It was only after several days that the filter worked at a pace of 40 mm. [per hour]. It then improved and ultimately filtered at the pace of nearly 80 mm.

The defect in the process of filtration was therefore shown to be due to the freezing of the sand layer on the surface during the cleansing. The freezing of the sand made the filter quite impermeable for water, and the filter at first, therefore, could not work at all. Gradually, however, the ice under the water and in contact with it must have melted away in various places, whereby the filtration could again take place, first, with a pace of 40 mm., and ultimately of 80 mm., or nearly the usual pace. These figures must be taken as meaning that the filter gave as much water as it would have given if its whole surface had been permeable and it had been filtering at the pace of 40mm. or 80 mm. respectively. But in this case the whole surface was not permeable, but probably only a small part filtered at all, for on the 3rd of February nearly the whole surface of the sand was found ice-bound. From this we can further conclude that the movement of the water through the unfrozen portion of the surface must have taken place at a rapidity in inverse proportion to the smallness of the permeable area. As we have no definite figures as to the extent to which the filtering area was diminished by the freezing of the sand surface, it is impossible to express in figures the pace of filtration, but in these circumstances it will have reached, undoubtedly, the maximum which was rendered possible by the existing difference of level between the unfiltered and the filtered water, *i.e.*, the filter worked with the small permeable area as badly as possible.

In former days it was contended that a freezing of the sand surface could not occasion disturbances in the process of filtration, as a thin sheet of ice which might possibly be laid under the water, which of course has always a temperature above freezing point, must shortly disappear. In this case, the first in which there has been a proper and careful investigation, we have a clear proof that the freezing of the sand surface can occur and can disturb filtration in a most serious manner. We shall therefore in future always have to reckon with this kind of disturbance in the case of waterworks having uncovered filters.

It is not even necessary, however, that the sand surface should be frozen to have difficulties of a serious character in filtration in winter. In order to be able in winter to cleanse open filters the occasionally quite

thick ice-coverings which are sometimes formed by the water still unfiltered standing above the sand must be removed. This ice-covering is broken and the ice taken in pieces out of the water. The Altona filters have proportionately a very small superficial area (something over 800 square metres) and it is not very difficult to remove the ice-covering when, as is the case here, the border of the filter is always kept free from ice. The greater the superficial area of a filter the more difficult it is to prevent the formation of ice on the filter. The Berlin waterworks outside the Stralauer Gate have uncovered filters which are nearly four times as great as the Altona filters. Here the cleansing of the filters in the winter is accompanied by nearly insuperable difficulties. Ever since the water has been bacteriologically investigated in the Hygienic Institute in Berlin, 1885–91, in each winter nearly there has been a period in which the water was insufficiently filtered. The cause of this was the impossibility of cleansing the open filtering basins which were past work (*i.e.*, too much covered with mud) but which were thickly frozen together. The whole of the filtration had therefore to be done by the few filters which were covered in and were therefore unaffected by the frost. To meet the demand with these few filters it was often impossible to avoid great irregularities in the process and the pace of filtration has exceeded a maximum of 200 mm. per hour.

The open filters of the Stralauer works are, however, not the largest. The new Hamburg waterworks have open filters of a superficies of 7,500 square metres, which are therefore nearly ten times as large as those of Altona. The future must show whether it is possible to keep filters of such dimensions free from ice and to cleanse them so rapidly that the sand surface does not freeze. According to past experience I think that this can hardly be done.

The winter with its periods of frost is not the only enemy of filtration. In summer there are also periods in which it is hardly possible to obtain a proper filtration. This is the case when the water becomes rich with microscopic plants (period of the so-called "water-bloom") and at the same time the consumption of water is at its highest. These microorganisms have mostly slimy integuments which rapidly stop up the pores of the filters and make them already, after even a few days, incapable of filtering properly. The increased consumption of water in summer does not permit a sufficient time being given for the filters to rest after cleansing; they are worked too soon after cleansing and at too high a pace of filtration, and as a result give a filtered water which is insufficiently purified.

Fortunately such disturbances, which occur often enough in nearly all filters, do not always produce similarly dangerous epidemics. There must be in the natural water the infectious matter, as well as insufficiency of filtration, to enable such a misfortune to result. Then, also, there is not a defect in the whole filtering works so that all the water goes unpurified through the filters, but as a rule this is only the case in one or a few filters which are temporarily filtering badly. The filter, also, even in the most unfavourable case, only permits a part of the infectious germs to pass. But that even this part can have an epidemic as a result has been seen in the typhus epidemics* in Altona, in the typhus epidemic in Berlin (1889) which had its origin in the Stralauer waterworks, and also the cholera epidemic in Altona during the two first months of this year.

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* *See* foot-note, page 449.

It has already been mentioned that, even in the first week of December the filtration was for a time insufficient. At that time Hamburg had been for some weeks free from cholera, and it was just then that the first isolated cases of the after-epidemic occurred (from the 6th to the 11th December, three cases). There was, therefore, at that time, not yet any infectious matter in the Elbe water, and the defect in filtration was without bad results for Altona. In the meanwhile the small after-epidemic in Hamburg (from the 20th to the 27th of December, 27 cases) was developed, with the result that infectious matter was communicated to the Elbe, and when towards the end of December the disturbance at the Altona filter which we have described at length occurred, the germs of infection were communicated thoughout that town and caused the appearance of isolated cases which could not be explained as having been brought in from Hamburg. The infection of the Elbe water can, owing to the small number of cholera cases in Hamburg, only have been slight, and apparently only two filters were defective, and it must be ascribed to these circumstances that the outbreak of cholera in Altona was restricted to small dimensions, and that when the filters were put into proper order it soon ceased. Had Hamburg at that time produced more infectious matter, and had the disturbances in the process of filtration lasted for a longer time, there would have been more serious results from this small after-epidemic. There would then have been reason to fear that as the drains of Altona communicate with the Elbe, there would have resulted a "vicious circle," so that the cholera would have wintered in Altona, a result which one would have avoided at all costs.

When I just now talked of infectious matter which was communicated to the Elbe water from Hamburg, this was not in any way a hypothesis, but, as has already been mentioned in a previous paper, cholera bacteria had been as a fact found in the Elbe water. They were found in the Elbe water a little below the place where the Hamburg main sewer flows into the Elbe. They were also found in one of the two basins into which the water flowed before filtration. In the filtered water, they were, it is true, not found, but they would probably have been found if greater quantities of water had been examined than was the case.

These are the facts which I have to state as regards the relation between water filtration and cholera with special reference to the epidemics in Altona and Nietleben. The question now arises, what are the lessons which we can draw from them as to the future.

It was due to the many and careful investigations which, during last year, were made at the waterworks of Berlin and Altona, as to the processes of filtration, and as to the bacteriological character of the water before and after filtration, that one was persuaded that it was a sufficient guarantee for the proper performance of filtration if the filtration was performed at a pace of 100 mm. in the hour. It has now been shown by the further experiences of these waterworks that by simply insisting upon this we do not arrive at any very satisfactory results. For, with the present arrangements, most waterworks cannot comply with this rule, and, as a matter of fact, do not comply with it. Still we should persist even in future that a pace of filtration of 100 mm. [per hour] should be the first condition, but we must so make clearer and complete the rule that the end in view will be reached with certainty. This can be done by further rules of the following character—(1.) The pace of filtration must not exceed 100 mm. in the hour. To make sure of this each separate filter must be provided with a contrivance by which the movement of water in the filter can be restricted to a certain pace and continually regulated so as to keep that pace. (2.) Each separate

filtering basin must, when in use, be bacteriologically investigated once each day. There should, therefore, be a contrivance enabling samples of water to be taken immediately after they have passed the filter (3.) Filtered water containing more than 100 germs capable of development in a cubic centimetre should not be allowed to reach the pure water reservoir. The filter should, therefore, so be constructed that insufficiently purified water can be removed without its mixing with the good filtered water.

To these rules I have still to add some observations.

In strictness the two last rules would suffice to remove the danger of infection from filtered water as far as it is possible to do so in the case of filteration through sand. But I think it questionable whether it is necessary always to insist upon the rule of a daily bacteriological examination of each separate filter. If waterworks, by their good construction and their proper and intelligent superintendence, give continuously good results, the strict insistence of bacteriological examination can be restricted to times of danger, *i.e.*, times when the consumption of water is greatest, periods of frost or danger of epidemics ; in the meanwhile, an examination every three days of the total filtered water would be sufficient. (Bacteriological examination as it now takes place—when it does take place—*i.e.*, a weekly examination of the total filtered water, is in all circumstances to be looked upon as insufficient.) In those periods when the bacteriological control is less strict there should be close and strict regulation of the pace of filtration, so as to have assurance that the process is properly carried out. Up to now we have only a few waterworks in which we have contrivances to restrict the filter to a definite pace. As a rule, the pace is calculated by comparing the total amount of water filtered in 24 hours with the superficial area of the filter, but everybody who is aware of the usual procedure at waterworks knows that in the course of 24 hours the demand made upon them is very different. At certain hours of the day a great deal of water is used, on the other hand at night very little. Unless there is a reservoir sufficiently great to cope with all these fluctuations, the changes in the demand can only be met by changes in the pace of filtration. The statement that waterworks are filtering at a pace of 100 mm. [per hour], if calculated in the manner explained above, has only a very doubtful value

If the bacteriological regulation of water filtration is to be carried out on a large scale, it must be so carried out as to give the results in the shortest possible time. For this purpose it is recommended to keep, as is the case in cholera investigations, the gelatine plates at a temperature of 22 ° in the breeding apparatus. Perhaps the time for obtaining a result can be still further shortened by the use of "agar" plates at a temperature of 37 °. As to this, I must refer to my previous writings as to an improved bacteriological diagnosis of cholera.

The supposition that filtered water containing more than 100 germs in a cubic centimetre is not sufficiently purified is quite proved by the experiences at the Altona Waterworks, which have been confirmed by experiences at other works. By this it is, of course, not to be supposed that water containing 101 or 105 germs is to be condemned without further investigation. This depends upon an intelligent judgment of a particular case, and the figure 100 is only intended to give a basis obtained from experience to form a proper judgment.

It does not require any explanation that each filter should be provided with an arrangement by which insufficiently filtered water can be removed. I would, indeed, not have insisted upon this requirement if

there were not several filter works which do not have such an arrangement. It is high time that everywhere care should be taken to remedy this very dangerous defect.

Rules as to the cleansing and recommencement of filtration, as to the degree up to which the sand layer may be allowed to wear away, as to the removal of the first water after the addition of new sand and after every cleansing, are not necessary if the process of filtration is regularly tested bacteriologically, and if the water which is, after the bacteriological examination, shown to be insufficiently filtered is removed. If this is done, the question need not be considered as to whether in our climate, in all circumstances, closed filters should take the place of open ones. It is the business of those in charge of the works to take care that the filtered water always satisfies bacteriological requirements. That construction and that use of the filters will always be the best which produce a water most free from germs. If, therefore, any contrivances are discovered which enable the open filters to filter well even in periods of frost, there is no reason why open filters should not be further used; if, however, such contrivances cannot be discovered the open filters should give way to covered ones. The managers of the several waterworks will have to make, aided by bacteriological investigations, their own rules for themselves. They will especially have to discover the time requisite to enable the natural water to form a good filtering mud layer, how much water after cleansing must be kept from use on the ground that it contains too many germs, how far one may allow the sand layer to be worn away, &c. It is also the duty of those in charge to discover the best means of meeting the demand if, as is often the case, too great a supply is wanted from the waterworks, and regular filtration cannot therefore be carried out. In one case the best means will be found to necessitate an enlargement of the works, in another it may be sufficient to remove waste of water by the introduction of water-meters. All this can, as I said, be left to the managers of the waterworks if they understand that it is their duty always to supply water which is bacteriologically satisfactory. In those cases, however, in which the managers do not understand how to regulate the waterworks bacteriologically, it will certainly be necessary, if mischief is to be avoided, most strictly to superintend the works as regards all these possible causes of disturbance. But who shall undertake this superintendence? Only the State can do it. It not only can but must undertake it; it is its duty. What is not already examined and superintended? Chemists' shops, hospitals, steam-boilers, factories, with their arrangements for the protection of their employees are under State control, in order to prevent that individuales should come to grief through want of skill or negligence. If a misfortune results from defects in waterworks it is not one affecting a few individuals, but the health and lives of thousands. Having been forced to this conclusion we cannot possibly leave these matters to look after themselves, and wait till even further mischief is done than was done in Hamburg and Neitleben by the cholera, or in Altona and Berlin by the typhus. It is high time that we should abandon a waiting attitude, and should resolve upon energetic action.

Our previous nearly blind trust in water filtration has been considerably weakened by the circumstances just described, and it will be the question in future in erecting new waterworks whether it would not be better to choose other water in place of surface water. Formerly only

spring water was considered to be a substitute for surface water, as the use of subsoil water was shown by several unfortunate experiments to be inadvisable, on account of the iron contained in it. But this difficulty is now much nearer solution, since it has been found possible to remove the iron in soil water in a simple and inexpensive manner by exposure to air and filtration. In this way a far stronger competitor to surface water has arisen, and it appears that thanks to these improved methods of eliminating the iron the early prejudices against subsoil water are gradually disappearing. This is seen by the fact that the number of works for the supply of subsoil water have been much increased in recent times. The first works were those of Halle, Leipsic, Dresden, Charlottenburg. Later on these were followed by those at Norderney, Kiel, Bonn, Cologne, Elberfeld, Duesseldorf, Mannheim, Dortmund, Muelheim, Oberhausen, Barmen, Kœthen, Krefeld, Linz, Pressburg, Budapest.

The subsoil water gives us absolute security with respect to the danger of infection, and it should, therefore, if it can only be obtained in sufficient quantity and if it is not objected to on account of chemical characteristics, *e.g.*, too great hardness or too great an admixture of chloride, be preferred under all circumstances to surface water.

I indeed hold it even to be desirable and in some cases even necessary that works already constructed to filter river water should be so changed as to be used for obtaining subsoil water. Why I think so I should like to explain by a definite example.

The Berlin Waterworks at the Stralauer Gate are very unfavourably circumstanced. When they were constructed the Spree at the intake was exposed to relatively little contamination. In the course of time, however, the conditions have considerably changed. The town has developed itself very considerably beyond the waterworks above the intake, so that the works are now within the town. A part of the fields which receive the sewage from the north of Berlin are drained into the Spree not far above the intake; the traffic of the Spree is much greater than it used to be; moreover, Koetenick, with its numerous laundries, is situated above the intake. If one takes all this into account the Spree water at the intake can hardly be considered better than the Elbe water below Hamburg. The arrangements of the waterworks leave a good deal to be desired in other respects, and we should not forget that they are the oldest on the Continent. As to the difficulties which the works have to encounter in winter with their open filters, these we have already discussed. Besides, in the period of a year, and even of a single day, the demand upon the works varies in so unequal a degree that with its small reservoirs it is unable to make provision for the considerable fluctuations in the demand. It must, therefore, of necessity at times filter at a pace beyond that which we have given as our maximum. If the works were not under the excellent superintendence of the Engineer Piefke, a man of repute both as to scientific attainments and practical experience, the result would have been worse than the typhus* epidemic of 1889. Those in charge of the waterworks, acquainted with the dangers of the situation, have in good time provided waterworks at the Mueggelsee (a lake) with covered filters in substitution for the Stralauer Waterworks. The works at the Mueggelsee are to commence operation on the 1st of July of this year, and on the same day the Stralauer Works will cease to be used. However, there are doubts whether one can do without the Stralauer Works. Should these doubts

* *See* foot note, page 449.

be confirmed the case would occur that I am now thinking of. I do not believe that if there were now again danger of cholera anyone would have the courage to undertake the responsibility for the further working of waterworks situated so dangerously. There would then be no other resource but to take in place of the Spree water a less dangerous or, if possible, quite innocuous water, and in such a case there would be no other substitute but subsoil water. Fortunately the conditions necessary to enable the Stralauer Waterworks to obtain subsoil water are as favourable as they are unfavourable for using river water. Previous experiments on the subsoil in the neighbourhood of the waterworks have shown that at a depth of about 15 metres there is a gravel bed of great extent and rich in water. A trial boring of 1·5 metres diameter driven into this gravel layer gave for a considerable period, without in any way diminishing its copiousness, daily 3,000 cubic metres of water. This water was found to contain iron, but it was from experiments with the water from this boring that the system which is now used to eliminate iron from subsoil water was discovered. It can, therefore, with certainty be stated that this water can be freed from iron. If the stream of subsoil water in this territory can be opened up by a sufficient number of borings, it would easily supply as much water as can be dealt with by the Stralauer Waterworks with their arrangements. In order that water may be freed from iron, it must first be exposed to the air and then be again filtered in order to remove from it the iron which has been separated. It would be, therefore, necessary to have some arrangement for aëration. It would not be necessary, on the other hand, to have any special arrangement for filtration, for the process of filtration in question is quite different from that which deprives the surface water of the micro-organisms contained in it. The flaky precipitate of hydratic oxide of iron which results when water containing iron is exposed to the air is easily kept back by thick sand or by gravel even at a very high pace of filtration. For this purpose the three covered filters of the works would be completely sufficient; the open filters could be completely abandoned and thus disturbances in the winter would in future be avoided. I think that I have therefore shown that with relatively small alterations these works which now give a water of doubtful value can be changed so as to give equal quantities of quite unexceptional water.

The conditions of many other waterworks known to me are similar to those ascertained in this case, and they might be improved by the adoption of the same principles.

In order to complete the discussion of the relations of water filtration to cholera, I must now, after this discusssion of filtration as it is carried out in the great waterworks, shortly consider filtration, as well artificial as natural, of water in small quantities.

For domestic filtration, *i.e.*, for the use of a family or of one house, there are small filters of a most varied construction at our disposal. Of these there are not many which can keep back micro-organisms, and therefore infectious matters, from the water, and those which can do so, *e.g.*, those made of silicious marl, aluminous clay, asbestos and celluloid, remain only a few days impermeable to germs, and very soon fall off

as regards the quantity of water they supply, and require a very careful handling. I am not aware of any small filters which suffice for practical wants for any length of time, and I should not advise depending upon small filters in times of cholera.

Far better are the results of natural filtration. Rain water, when it sinks into the ground, and ultimately becomes subsoil water, passes through far thicker layers and with far less rapidity than river water when passing by artificial filtration through sand filters. If the soil is only sufficiently granulated, we have in soil filtration a much more perfect process than is at our disposal in artificial filtration. As a rule the soil is of a material much more finely granulated than the comparatively coarse grained sand of the filter, and it is fair to expect that the subsoil water, after passing sufficiently thick layers of this finely-granulated soil, will be either very poor in micro-organisms, or quite free from them. This is confirmed by the investigations of C. Fraenkel, who has shown that subsoil water, even in a soil which has been much and for a long period contaminated, as in the case in Berlin, is quite free from germs. In other places the same results have followed from investigations made on this point. We have, therefore, no reason to keep out of consumption the subsoil water, which can be found nearly everywhere. On the contrary, we cannot find a better filtered water and one more protected against infection. The only difficulty is to bring this perfectly purified water into consumption without its being later on again contaminated and infected. In this respect great errors are still most inexplicably made everywhere.

If the subsoil water is raised by means of an iron conduit pipe, the possibility of contamination is avoided. The soil is so close to the pipe that no real disturbance of the filtering layers of the soil are produced by the boring. All liquids, even those most strongly contaminated, must before reaching the depth from which the water is raised pass through thick and efficient filtering layers, by which they are rendered absolutely free from infectious matters. Especially is this the case if the boring goes through an upper impermeable layer into deeper sand or gravel layers containing the water. Water coming from such depths will certainly nearly always contain some iron, but this is, in the case of a single pump, as also in the case of large filters, no reason for rejecting the water. It will only be necessary to free the water from iron according to the methods above described, *i.e.*, by exposure to air and filtration, in order to obtain quite excellent water in no way inferior to the best spring water. For this purpose the method given by Piefke is to be recommended, as it has proved itself to be excellent at Hamburg in the case of a number of pumps giving water containing iron.

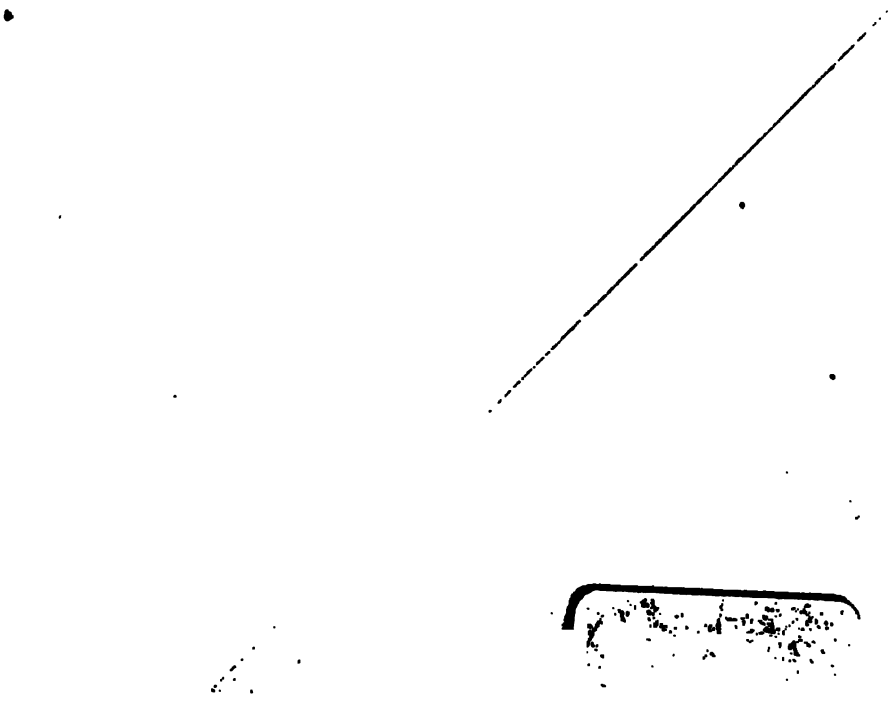
The most rational way of obtaining subsoil water is undoubtedly by the use of iron pumps. There is, it is true, the objection against it that the pumps gradually bring up less and less water. But it has been observed that this has nearly always been due to the fact that the metal sieve which is intended to protect the pipe at the lower punctured end against sand has been stopped by mud and become encrustated. But it will be easy to find a means of avoiding this by giving such a construction to the lower end of the pipe as to enable the metal sieve when stopped up to be removed and to put a fresh one in its place.

Iron pumps are unfortunately still too little used. Almost everywhere the subsoil water is obtained in the old-fashoned but most irrational system of wells. The construction of the well is such that from underneath,

i.e., from the subsoil water, if the bottom of the well is deep enough and is in a good filtering soil, only good filtered water can come into the well. But from above the well is nearly always exposed to very serious contamination. Very often the wells are quite open or insufficiently covered; but even if they are covered above by masonry, or by iron plates, nearly always in the uppermost layers of the soil surrounding the well, which in summer become quite dry and in winter are exposed to the frost, there are cracks and fissures which allow unfiltered water coming from these unfiltered layers to leak into the well. Even masonry or cement is, when subjected to these influences, so cracked and fissured as to be unable to prevent the water flowing from the surface of the soil to reach the well. But this very water can be very badly contaminated, for the water of the well is used at the well for laundry purposes and for the cleansing of domestic utensils. Contaminated in this way, and possibly infected, it finds its way through the cracks and fissures of the covering back into the well. Besides the wells are generally situated in the lowest part of a district. As a result they receive the filth of overfull dung-heaps, gutters, &c.; and often the rain washes towards the well filth from human dwellings even if situated at a considerable distance. The fact that epidemics having their source in well water are generally observed to occur after a heavy rainfall is to be ascribed to the above fact. A proof that even cholera infection can have its source in a well contaminated in such a manner is to be found in the case of a well in the neighbourhood of Altona, into which filth had been allowed to pass from the surface. As to this case, I shall have to report in another paper.

Wells, constructed no matter how, should not be tolerated in future, if they are exposed to contaminations of this character, even if there is only suspicion that such contamination might take place.

It will certainly not be easy to arrange that wells already in existence, even if badly constructed and dangerously situated, should be given up; but that is not always necessary. It will be comparatively easy in most cases so to alter the construction of the well as to remove all danger of contamination from above. It is only necessary to give to the well the same protection, or approximately the same protection, against contaminating percolations by means of filtering layers of soil such as exist in the case of a simple pump. To achieve this, one should proceed by filling the well up to the highest water point with gravel, and over the gravel with sand up to the very top. Here it is of course assumed that the well is already provided with an iron pipe, or, if this is not the case, that it will be provided with one before the gravel and sand are put in. In this way the well is turned into a pump, with the advantage over other ordinary pumps that its lower end dips into a layer which gives no resistance to the subsoil water. If it is proposed to keep the water-supply of the well quantitatively intact in order that, for instance, for purposes of extinguishing fires, a certain quantity of water should be at hand, there should then be erected above the highest point reached by the well water a construction of masonry or of iron capable of lifting the protecting sand covering. But the last should never be less than two metres deep. It is also to be recommended that the pump should not be erected immediately over the well, but some distance from it, and that it should be put into communication with the well by a lead pipe. This would prevent the water of the well, which when used for washing and other domestic purposes becomes foul, from leaking into the soil around.

Wells protected in this or similar methods, by good filtering layers, give the same protection against the infection of water as is given by the sand filtration of the great waterworks. In fact they really give a greater protection, for they are not exposed to the many disturbances in the process of filtration referred to previously and are also not affected by frost.

So much attention is now being given to perfecting as much as possible the water-supply of the great waterworks, that it is important not to lose sight of the domestic water-supply by pumps and wells. By improving the wells in the manner explained above, the spread of cholera, in so far as it is due to water, can be restricted to a great extent. It is just in this respect that a great deal can yet be done.